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USSR Report

ENERGY

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OIL AND GAS

SCIENTIFIC CENTER FOR CONTINENTAL SHELF DEVELOPMENT ESTABLISHED

Moscow GAZOVAYA PROMYSHLENNOST' in Russian No 8, Aug 83 p 47

[Article: "Scientific Center for Continental Shelf Development"]

[Text] On 1 June 1983 an order by the Gas Industry Ministry established the NTTs [Scientific Center] to promote the further elevation of the role of VNIIImorneftegaz [All-Union Scientific Research Institute of Ocean Oil and Gas] as the chief organization in outlining the principal directions of scientific progress, improving of coordination of operations in targeted comprehensive scientific and technical programs, and programs to solve crucial science and technology problems in the development of oil and gas resources on the USSR continental shelf.

The Scientific Center is an organ for planning goals and programs, and managing the scientific research and experimental design activity in the gas industry in the development of oil and gas resources in the above area. The director of VNIPImorneftegaz [All-Union Science, Research and Planning Institute for Ocean Oil and Gas] heads the Center.

The Center's coordinating committees organize the execution of targeted programs. Under the auspices of the Center, there will be scientific problem committees to evaluate the status of scientific research, develop recommendations for its further support and to develop the theoretical foundations of the technology of the future for the development of the ocean's oil and gas resources.

Results of the Center's work and principal tasks for the upcoming period will be reviewed annually at the Directors' meeting chaired by the director of the Center.

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OIL AND GAS

EFFECTIVE ADDITIVES FOR DRILLING MUDS

Moscow GAZOVAYA PROMYSHLENNOST in Russian No 8, Aug 83 pp 26-27

[Article by Ye. A. Konovalov and O. N. Spiridonov of Lenaneftegazgeologiya:
"Effective Components of Drilling Muds"]

[Text] Industrial tests have shown that such structurizing materials as water glass, ammonium sulfate and asbestos may be used successfully for preparation of various drilling and cement muds, as well as for displacement and plugging-back compounds.

Analysis of oil and gas deep drilling data at the PGO [not further identified] "Lenaneftegazgeologiya" shows that, even using highly effective drilling equipment and tools, high technical and economic indicators may be achieved only by the correct choice of the type and indicators of drilling mud. Light plugging-back mixtures utilized in combination with special displacement fluids are necessary for quality casing and cementing, and reliable insulation of the intake beds. These recommendations may be realized, primarily, by taking into account the geological and technical conditions of well drilling and opportunities for its material and technical supply.

Anomalously low formation pressures (ANPD), low bed temperatures, high mineralization of formation water, and the presence of absorption zones and layers of unstable terrigenous rock are characteristic of Yakutiya's prospecting areas. Two basic types of drilling muds are used for well drilling: stabilized clay muds--in terrigenous and terrigenous-carbonate deposits, and sodium chloride brines--in the halogen-carbonate deposits. The drilling muds' technological indicators are formed by adding KMTs [Carboxymethylcellulose], "gipan" [hydrolyzed polyacrylonitrile--hypan], USHchR [not further identified], nitrolignin, soda ash, SMAD [not further identified] and other agents. Cement slurries with a calcium chloride additive to accelerate setting are mainly used to cement casings and insulate intake beds.

The low quality of clay powders in Yakutiya (drilling mud yield from 1 ton of powder is no more than 6-8 m³) prevents obtaining drilling muds based on them with a density less than 1,120-1,140 kg/m³. When wells are drilled in terrigenous-carbonate deposits, the indicators of the utilized drilling muds substantially worsen due to the aggressive formation waters, necessitating constant treatments of the mud with chemical agents (KMTs, MK and others).

The drilling of a single well to a depth of 3,500-4,000 m uses up 150-250 tons of clay powders, 15-25 tons of KMTs, hydrolyzed polyacrylonitrile and MK. The solid phase of the utilized drilling muds usually exceeds 20-25 percent, which substantially lowers production indicators for the drill bits.

It was proposed to use other structurizing materials, such as water glass, ammonium sulfate and asbestos to obtain drilling muds with a reduced solid phase. The first is a local material for the PGO "Lenaneftegazgeologiya," since it is produced in a rather large quantity directly in Yakutsk; the second and third are available, inexpensive and practicable. Selection of these materials is also determined by the fact that they may be used not only for preparation and treatment of drilling muds, but also as components of cement slurries, plugging-back and buffering slurries (Table).

Water glass is used successfully in low-silicate clay muds (MSGR), polymer aluminosilicate drilling muds (PASR) and undermine-resistant cement slurries (SUTsR). It is most widely used in the preparation of low-silicate clay muds. The first industrial tests showed that MSGR was highly effective in Yakutiya's terrigenous and terrigenous-carbonate deposits; this served as the basis for the massive introduction of these muds. The annual savings from use of MSGR, achievable due to the substantial reduction of well treatment and hole conditioning time and reduced consumption of clay powder, is 200-250,000 rubles. At present clay muds are treated with water glass in practically all of the wells in Western Yakutiya's areas with unstable terrigenous deposits.

Undermine-resistant cement slurries were successfully tested in ANPD intervals during casing of wells and recommended for wide use. Their use allows a 25-30 percent reduction in the consumption of plugging-back slurries.

Ammonium sulfate is a component of PASR, aluminum acid salt gels (GSA), polymer alumoacrylic muds (PAAR), light gypsum salt gel cement slurries (OGSTSsR) and viscoelastic compounds (VUS) with a carboxymethylcellulose, polyacrylamide and hydrolyzed polyacrylonitrile.

Aluminum acid salt gels were tested during drilling under conditions of salt water production. The material consumption for preparing GSA is 3-5 times less than for salt-saturated clay muds and magnesium hydrogels.

Polymer alumoacrylic mud ($\rho=1050/1080 \text{ kg/m}^3$) was tested during the drilling of two wells in conditions approximating equilibria in the well-bed system. Aluminum sulfate consumption with use of this mud is low (1.2-1.5 kg per 1 m of penetration). The use of this mud (PAAR) requires a relatively small increase in the consumption of commercial hypan compared with the standard clay mud (from 3-3.5 kg to 4.5-6 kg per 1 m of penetration). However, judging from the first test results, these extra expenses are justified by the avoidance of expenses associated with the transport and use of clay powders (100-120 tons), an increase of mechanical speed (by 1.5-2 times) and bit penetration (by 20-30 percent) compared with the best wells, drilled with hypan-stabilized clay muds. PAAR may be used more effectively when means for high-quality treatment of drilling muds are available.

(1) Наименование	(5) Добавки реагентов, мас. %									
	(6) КМЦ-600	(7) Гипан (товарный)	(8) Серно-сернистый алюминий	(9) Кремнекислотное кальциевое К-6-20	(10) Агент Агент	NaOH	CaCl ₂	NaCl	MK	Na ₂ CO ₃
(2) Буровые растворы: малосиликатный глинистый полимерный алумосиликатный полимерный алумоакриловый гидросолгель алюминия	0,2—0,8 1,2—2 — 0—1,5	0,5—2 — — —	0,7—1,5 1—1,5 5—7 —	1—3 5—7 — —	0—2 0—2 0—3 —	0—0,1 0—0,2 0—0,3 0,8—2,5	— — — —	0—1 2—25 — 0—25	0—1 0—1 — 1—3	0—0,2 — 0—1,2 —
(3) Цементные растворы: супфразионно-устойчивый облегченный гипосолгельевый	— — — —	— — — —	— — 3—5 —	— — 3—8 —	— — — —	— — — —	— — — —	— — — —	— — — —	— — — —
(4) Вязкоупругие смеси (буферные и тампонирующие): на основе КМЦ на основе гипана	3—4 —	35—70 —	0,3—1 —	3—8 —	— —	— —	— —	— —	— —	— —

Key:

1. Item
2. Drilling Muds:
low-silicate
polymer alumosilicate
aluminoacrylic
aluminum acid salt gel
3. Cement Slurries:
undermine-resistant
4. Viscoelastic Compounds
(buffer and plugging-back):
on a carboxymethylcellulose base
on a base of hydrolyzed polyacrylonitrile (hypan)
5. Agent additives, % mass
6. KMTs-600
7. hydrolyzed
polyacrylonitrile (hypan)
(commercial)
8. aluminum sulfate
9. water glass
10. K-6-20 asbestos

The use of light gypsum salt gel cement slurries ($\rho=1510/1620 \text{ kg/m}^3$), as industrial tests showed, allows a 20-30 percent reduction of cement consumption while providing good quality formation segregation in a temperature range of 8-50 degrees centigrade. The thickening and setting periods at various temperatures may be controlled by changing the water-cement ratio (from 0.8 to 1.1), the concentration of aluminum sulfate and calcium chloride, and the dosage of retarders (VKK, oxyl TPFN [not further identified], and others). The annual economic result of using OGSTsR exceeds 40,000 rubles.

Viscoelastic compounds with a KMTs, hypan and PAA base with aluminum sulfate additives may be used effectively during isolation of absorption zones in combination with alluviation of fillers and injection of fast-setting cement compounds. The economic result of performing isolation work with this technology is 8-10,000 rubles and more, calculated per single operation. Viscoelastic compounds of polyacrylamide and aluminum sulfate is successfully used in the cementing of casings as a buffer fluid, and the compound $\text{KMTs}+\text{Al}_2(\text{SO}_4)_3$ for cleaning cuttings from the bottom-hole (removal of sludge plugs).

Brand K-6-20 asbestos may be used in all of the examined drilling muds and plugging-back compounds as an extra structurizing material. Thus a dosage of 0.5-2 percent asbestos in MSGR reduces the clay phase to 5-7 percent. Adding 1-3 percent asbestos to GSA reduces aluminum sulfate consumption by 40-60 percent, and stabilizes the mud's structural, rheological and filtration properties. It is advisable to use asbestos as a fibrous filler in water- and hydrocarbon-based drilling muds when drilling wells in conditions of low-level circulation losses ($2-5 \text{ m}^3/\text{h}$). Asbestos should be used in combination with other larger fillers when combatting extreme circulation loss.

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COAL

ENTERPRISE MANAGERS RESPOND TO QUESTION ABOUT LAGGING

Why Contracts for Coal Deliveries Are Broken

Frunze SOVETSKAYA KIRGIZIYA in Russian 1 Jun 83 p 1

[Letters of enterprise managers in response to question about lagging: "Four Answers to a Question"]

[Letter from A. Peretyat'ko, inspectorate department chief, Kirgizuglesnabsbyt [Kirgiz Coal Supply and Marketing] Administration]

[Text] Outside the window it is June, while this letter is about fuel and coal. Even in the summer fuel is extremely necessary to the contemporary economy. TETs and boilers must operate so that electrical energy, hot water and steam will be unfailingly supplied to enterprises, organizations and residences. Unfortunately, since the very beginning of the year Kirgizulesnabsbyt has constantly experienced difficulties in supplying coal to customers both within the republic and outside its boundaries. The four month plan for interrepublic deliveries was 93.8 percent fulfilled, including 95.7 percent for Uzbekistan, 78.5 percent for Kazakhstan and 98.5 percent for Turkmenia. There is a difficult situation with fuel supplies to many industrial enterprises and organizations in Kirgiziya. For example the Ministry of Land Reclamation and Water Resources was shorted 9,000 tons, the Ministry of the Meat and Dairy Industry more than a 1,000 tons, and the Ministry of the Fruit and Vegetable Industry 900 tons. The main reason for delivery disruptions is the nonfulfillment of coal extraction plans by these mine administrations: Sulyuktinskoye (83,000 tons), Tash-Kumyrskoye (6,900), Dzhergalan (9,000). The situation is made even more difficult by the fact that coal extraction enterprises are little concerned about fuel quality. The Almalyk Strip Mine is among those not fulfilling the plan for the delivery of high grade and large-medium coal.

In May also coal extraction in the republic was lagging behind the plan. According to current data, since the beginning of the second quarter the coal delivery shortfall is 32,000 tons.

Republic Gossnab has repeatedly turned for help to the Sredasugol' [Central Asian Coal] production association and the Issyk-Kul' oblispolkom. However, the situation does not change.

We Are Coming in on Schedule

Frunze SOVETSKAYA KIRGIZIYA in Russian 1 Jun 83 p 1

[Letter from L. Yel'nik, director, Tash-Kumyrskoye Mine Administration]

[Text] The difficult situation into which we fell a few years ago is finally being corrected. The problems had to do with our running into very unfavorable mining geological conditions in the Severnaya Mine. This naturally had an effect upon fuel extraction.

We were helped by scientists from sectorial institutes in Moscow and Karaganda and from the Physics and Mechanics of Rocks Institute of the Kirgiz Academy of Sciences. Kuzbass miners visited Tash-Kumyr and shared their experience with work under similar conditions.

The recommendations of scientists and practical workers were useful. Underground extraction began to gradually increase, but the previous level was not attained. It was then decided to expand coal extraction by the surface mining method, primarily at the promising Tegene Strip Mine. The extraction plan became more even. However, there was still lagging in the delivery of large fraction coal.

In April, for the first time in many months, the targets for extraction and the delivery of graded coal were met. We also count on successfully meeting the production plan and contractual obligations for the second quarter. The collective of the Kara-Su Strip Mine intends to meet the target for three years of the five-year plan by June, and the mine administration collective plans to meet it by 25 December.

Lagging a Year Behind

Frunze SOVETSKAYA KIRGIZIYA in Russian 1 Jun 83 p 1

[Letter from V. Shagiakhmetov, acting director, Sulyuktinskoye Mine Administration]

[Text] The complaints addressed to us are justified. The mine administration indeed did not fulfill the four month plan for coal extraction and for its delivery to customers. The main reason was lagging in the volume of overburden stripping work at the Kyz-Bulak Strip Mine. Because of this we do not have reserves ready for extraction.

The situation has deteriorated in Mine 2/4 as well. At longwall No 48 we encountered seams in bad condition, and, naturally, coal extraction fell sharply. Because of serious geological disturbances longwall No 49 had to be closed down entirely.

There is one way out of the situation: thoroughly accelerate stripping operations at the Kyz-Bulak Mine in order to make up shortages and create an extraction front as rapidly as possible. Even last year much was done in this direction. However,

although 5.7 million cubic meters of rock was moved the target was not reached, the shortfall amounted to 110,000 cubic meters.

We now have a powerful fleet of excavators and BelAZ [Belorussian Motor Vehicle Plant] trucks. The January - April plan for excavation work was fulfilled at a pace setting schedule. The rates will be accelerated in the future. After all, in order to overcome previously allowed shortcomings in stripping work it is essential to excavate about eight million cubic meters of rock. This is almost a year's program.

Help is Needed

Frunze SOVETSKAYA KIRGIZIYA in Russian 1 Jun 83 p 1

[Letter from K. Kifel', chief engineer, Dzhergalan mine]

[Text] It is clear: no coal extraction means no deliveries in full amounts. Mine collectives are experiencing plan disruptions. We are letting down the Przheval'skaya TETs, the brick plant and the Kurmentinsk cement plant.

We are lagging because we did not make timely provisions for coal removal work due to the development of a coal spontaneous combustion site. It was necessary to work the fuel remaining in the block by another method, one which led to larger than usual underground losses of the coal. As a result, extraction has declined.

We attempted to correct the situation, preparing a new excavation block. However, conditions turned out to be unsuccessful in a geological sense, coal extraction from it was one-half the required amount. In addition, the bed is geologically fragmented, considerably increasing excavation labor intensity.

We see the solution in the preparation of a new block. It will be put into operation by the end of the year. Having two blocks, less will depend upon surprises of all sorts. If, for example, conditions deteriorate in one block, we will expand extraction from the reserve.

The situation would straighten out more rapidly if Sredazugol' Association would assist us with spare parts for trucks and bulldozers. The mine also needs ventilators for its preparation plant. This will enable us to increase the volume of preparation and improve coal quality.

The Problem is Transportation

Frunze SOVETSKAYA KIRGIZIYA in Russian 1 Jun 83 p 1

[Letter from V. Lobachev, chief engineer, Almalyk Strip Mine]

[Text] Almalyk has not completely fulfilled its contractual obligations. Here is why. We are obliged to use our own transport to haul coal from the mine site to the railroad station. Our transport has not been in order for a long time. Our KrAZ [Kremenchug Motor Vehicle Plant] trucks have sort of lost their shoes

because last year we were shorted 100 sets of tires. Naturally, grading (the plan was not fulfilled in the first quarter) and delivery to customers are also limping along.

In February and March the sets of tires for the KrAZs were received and the trucks went into operation. In April we not only fulfilled the monthly plan for extraction and shipment, but also made up our debt from the first quarter. However, we were not able to meet the target for delivering graded coal to customers. Calculations show that in the second quarter this plan indicator will be met.

From the Editor

Frunze SOVETSKAYA KIRGIZIYA 1 Jun 83 p 1

[Editorial: "From the Editors"]

[Text] Today we publish enterprise managers' answers about the reasons for lagging. Unfortunately, not all of them are distinguished by objectivity. For example, the chief engineer of the Almalyk Strip Mine attributes the main reason for the disruption in first quarter deliveries and the poor quality of coal in April to the bad condition of motor transport. Indeed, motor transport badly let down the Almalyk miners during January - March. However, the lack of tires for the KrAZ trucks was not the sole reason for the situation. A much greater influence was had by the poor organization of work at the transportation shop, and the vehicles' bad condition, causing them to break down right and left. This, in particular, was stated in a letter from the worker Comrade Koshuyev "If Taken Together" published in SOVETSKAYA KIRGIZIYA on 27 Feb.

The situation at the Sulyuktinskoye Mine Administration and Dzhergalan Mine is also not caused by any single objective reasons. The difficult geological conditions which they encountered were to a significant extent made more complicated by lack of foresight and a concern for tomorrow. Coal was gathered as long as it was put in their hands, but fronts were not prepared for the future. Neither did the manager of the Sredazugol' Production Association make prompt corrections on the spot even though there were signals that his help was needed. At the 30th City Party Conference in Syulyutka, for example, communists raised the question about the lack of elementary conditions for vehicle repair at the surface operations section. Repairs are made where the misfortune takes place. This same conference discussed the fact that the association must solve the long urgent problem of building a new mine in the 11th field and improve the miners' settlement of Vostochnyy. Sredazugol' was informed about these signals. However, there has been little change in the situation. As previously, heavy equipment frequently goes out of order, while conditions at the mine administration permit only small and medium repairs. Dump trucks must be sent to Kemerovo for capital repairs. The long trips there and back by no means help increase work intensity at the Kyz-Bulak Strip Mine. It is no accident that studies by specialists at Kirgiz SSR Gosplan show that the Syulyutka miners will not succeed in making up the shortcomings until next year.

Disruptions in delivery of any product are fraught with all sorts of complications for customers. This is doubly true for coal for which there is no substitute.

COAL

COAL OFFICIAL ANSWERS COMPLAINTS ABOUT KATEK

Moscow EKONOMICHESKAYA GAZETA in Russian No 15, Apr 83 p. 2

[Article by V. Belyy, first deputy minister, USSR Coal Industry: "On the Review of the Kansk-Achinsk Fuel-Energy Complex (KATEK) (No. 2)"]

[Text] The survey materials were examined by the management of USSR Minugleprom [Ministry of the Coal Industry]. The ministry board discussed the state of construction on the experimental-production installation for coal liquefaction (ST-5) at the Bel'kovskaya Mine of the Novomoskovskugol' [Novomoskovsk Coal] Association.

The board noted the unsatisfactory work on this project and strictly reprimanded the following production association managers: comrade Potapenko, Novomoskovskugol'; comrade Alekhin, Soyuzshakhtostroy; comrade Shal'nov, Soyuzshakhtoprojekt and comrade Virabov, Ugletekhsnab.

Specific organizational-technical measures were developed and introduced for the operational introduction of the ST-5 installation in the first half of 1983, for increasing the number of construction and installation workers on the project, the top priority delivery of materials and equipment and for accelerating the deadlines for the manufacture of non-standard equipment.

As far as the construction of the ST-75 experimental-production installation is concerned, in 1983 it is intended to increase the target by 500,000 rubles over the plan for completed work, and finish work on the zero cycle installation for the entire complex. Jointly with USSR Minneftekhimprom [Ministry of the Petroleum Refining and Petrochemical Industry] and the USSR Ministry of Installation and Special Construction Work and other concerned organizations, USSR Minugleprom is working out a directive schedule for the installation of the ST-75 which includes completing the development and delivery of planning documentation, the manufacture and delivery of the essential process line equipment, the completion of construction-installation work for putting the project into operation in 1985 as intended by the targeted scientific-technical program.

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COAL

CHANGES IN EKIBASTUZ MINING OPERATIONS PLAN PROPOSED

Moscow UGOL' in Russian No 8, Aug 83 pp 34-36

[Article by candidates of technical science, I. A. Tynterov, E. B. Vagin (NIIogr) [Possibly: Scientific Research Institute for the Organization of Mining Operations], and candidate of technical science A. Ye. Anpilogov (KATEKNIIugol' [Kansk-Achinsk Fuel and Energy Complex Scientific Research Institute for Coal]): "Development of Mining Operations at the Ekibastuz Deposit"]

[Text] The further development of the Ekibastuz Fuel and Energy Complex will play a great role in solving problems of meeting the nation's needs for electrical energy. About 70 million tons of coal annually are extracted from the pits of the ETEK [Ekibastuz Fuel and Energy Complex]. It is planned over the long term to increase coal extraction to 150 million tons.

The entire deposit has been provisionally divided into 12 geological exploration sections. Mining operations are being conducted on sections 1, 2, and 3 in the northern part of the deposit (the "Northern" and "Southern" stripping pits and the "Central" extraction pit), on sections 5 and 6 in the southern part (the "Stepnoy" stripping and the "Bogatyr" extraction pits). Section 9 is being prepared for excavation and construction work is underway at the "Eastern" pit in section 7 and partially in 8. Later on it is planned to designate the northern group of pits the "Northern" and the southern group the "Southern". They will have respective capacities of 50 and 100 million tons of coal annually (according to data from Karagandagiproshakht [Karaganda State Mining Institute].

The mining operation situation at the deposit is characterized by a considerable lack of concentration. In the northern part the work front is about 9 kilometers long and 160 meters deep, while in the southern part the figures are 6 km and 70 m. In the northern part the total length of the stripping faces is 100 km and of the extraction face more than 48 km. The advance of both types of faces does not exceed 45 meters annually, this is 1.5 - 2 fold less than at pits with railroad transport. The total length of railroad track is around 750 km, including more than 320 km of movable track. Mining operations are dispersed with regard to length, depth and width. The upper stripping faces somewhat outpace the middle and lower, hindering reserve preparation with considerable amounts of stripping work. This is supported by a study

* The engineers R. M. Gusev and A. F. Ponomarev (NIIogr) participated in the preparation of this article.

by Karagandagiproshakht in 1979. In determining the amount of stripping work lagging at the "Northern" and "Southern" pits it was found that lagging mainly occurs at lower stripping horizons. The resulting dip angle of the working bank at sections 1, 2 and 3 is 11-13 degrees, and at sections 5 and 6 it is 8 degrees, while if normal working areas are maintained this angle could be 15 - 18 degrees.

The "Northern" pit, dug during the first stage works beds 1, 2 and 3 in those parts where the angle of deposition is greatest. Therefore, even with a small advance of the mining operation front, deepening is quite intensive (up to 8 meters annually). This rapidly increases the stripping coefficient, which has already reached 1.85 cubic meters per ton, exceeding the average coefficient for the deposit. The deposit has more gently sloping outcrops at which it is possible to effectively conduct mining operations. Planning decisions only provide for the development of beds 1, 2 and 3. There are no plans to work bed 4, which is 20-25 meters thick and covered with 30-80 meters thick interbed rock. This prevents using the worked out area for internal spoils banks.

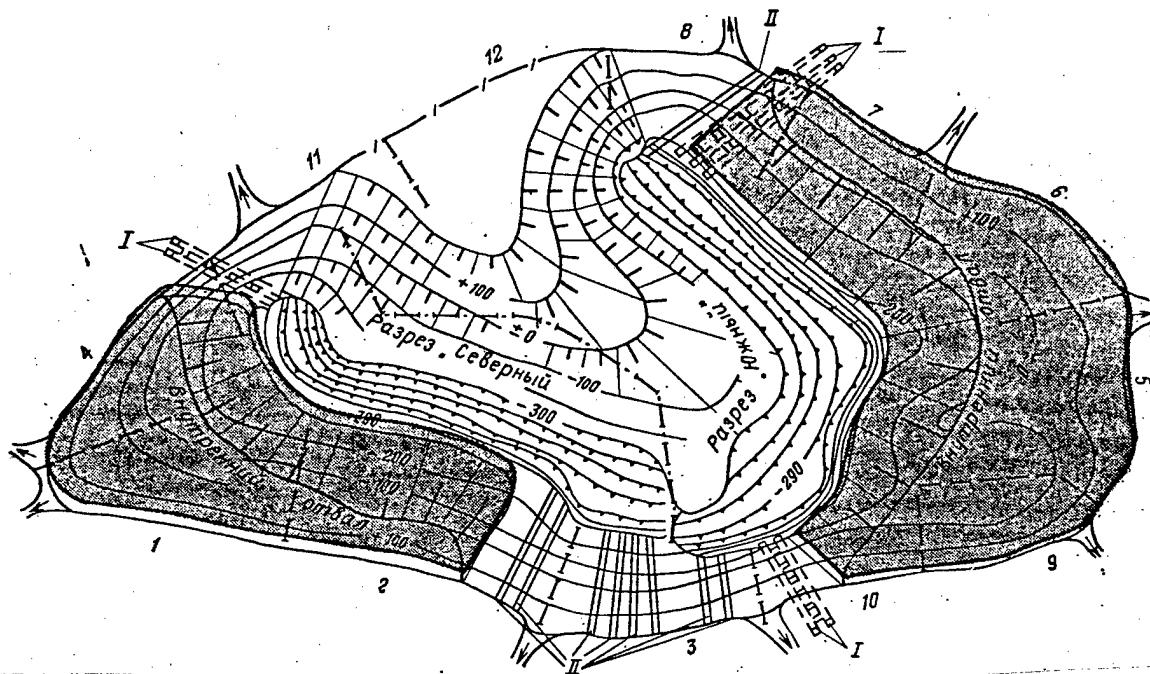
Thus, there are a number of substantial shortcomings in the procedure for working the deposit undertaken in the initial period: mining operation dispersion, the irrational selection of sections 1, 2 and 3 as the initial ones and the elimination of the development of bed 4. The lack of a general scheme for the development of the Ekibastuz pits to their total depth hinders the development of rational planning solutions for subsequent periods of operation.

Because of this it seems necessary to determine some directions for the more rational conduct of mining operations at the Ekibastuz deposit.

One such direction involves the rational location of spoils banks. At present stripped overburden rock from all pits is hauled to external spoils banks up to 11-12 km away, as depth increases this distance will grow to 25 km. However, as experience shows, it is possible to organize internal spoils banks at the "Bogatyr" and "Northern" pits. This requires beginning the development of bed 4. This would mean a volume of interbed rock and cut bank excavation during bed extraction which would amount to 6.7 billion cubic meters and a stripping coefficient of around 2.4 cubic meters per ton.

Let us examine the procedure for conducting mining operations at the 400 m horizon with a working zone depth of 600 m (see the diagram). Stripped overburden rock from the 3-4 upper horizons is hauled by railroad out through a cut in the surrounding deposits to external spoils banks. The overburden from the lower horizons is moved along a semistationary ramp to the appropriate layers in the internal spoils bank. The interbed rock is often worked by a non-transport method, with part of it dumped in an internal spoils bank. Coal from beds 1, 2, 3 and 4 is transported to the surface by conveyors on an inclined shaft or surface hoists. If bed 4 at horizon 400 m is worked and EKG-12.5 excavators are used at the spoils bank with layer height of 30 m, with a coefficient of rock expansion of 1.3, then the capacity of the internal spoils bank at the "Southern" pit is around 5 billion cubic meters. The incline angle of the spoils bank does not exceed 17.5 degrees. If the

Mining Operations Plan at Working Zone Depth of 600 Meters



1-12.-- Deposit Development Sections.

I.-- Sloped Shaft.

II.-- Conveyor Lift.

spoils bank layer is 60 m high the incline angle of an ESh-13/50 excavator is 18 degrees. Increasing the spoils bank height will permit an even greater increase in internal spoils bank capacity. The bank work front length is 7.5 km, the average haul length 5.2 km and external spoils bank capacity 3-4 billion cubic meters. Sloped shafts or conveyor lifts of the surface type can be located on the stationary west edge of the "Northern" pit, in places not lowering the internal spoils banks (section 3), and sloped shafts in the section 8 region. The selection of the location and number of conveyor lifts will be determined after working out the appropriate studies using the variant comparison method, with consideration given to existing stripping developments.

- х Depending upon mining geological and engineering conditions, internal spoils banks might primarily be created at sections 5 and 6. The organization of internal spoils banks requires the timely initiation of operations at bed 4. The advance of the work front along the bed should outpace the advance along the main beds until an overall edge bank for the pit has been formed. The organization of such a bank for all beds includes several stages: increasing the incline angle at the working banks of pits in operation to 18 degrees,

This will assist the redistribution of stripping work and the use of partially available equipment for working bed 4; the accelerated working of bed 4 (a 150 m annual advance) using the non-transport method. The thickness of overburden worked by the non-transport method can reach 40 m. Bed 4 can be worked by either railroad or truck transport. The work volume at sections 5 and 6 to horizon + 150 m is 38 million cubic meters of interbed stripping and 14 million tons of coal if the coal front is 5 km long. At a sinking rate of 15 m annually coal extraction from bed 4 is 4.5 million tons and overburden stripping is 10-12 million cubic meters.

In order to determine the possibility for the very rapid development of internal spoils banks it is essential to examine a variant for stripping bed 4 by transverse trenches at the attained working depth of the "Bogatyr" pit (horizon +94 m) with the construction of a nonworking bank along the interbed with an incline angle of 30-32 degrees (without additional working of the bank) and the conservation of bed 4 reserves in the upper horizons (excavation costs to be charged to future periods). The main period of exploiting the deposit through the "Northern" and "Southern" pits begins with the complete transition of stripping work to internal spoils banks. The work front will stretch across the entire width of the syncline and move along its long axis.

The acceleration of the transition to the basic work plan with internal spoils banks at the "Northern" pit requires the intensification of mining operations at outcroppings of the strata series (sections 4 and partially 11). It is advisable to conduct the work in the following sequence: uncover beds 1, 2, 3 and 4 and build stripping and extraction work fronts at sections 4 and 11; intensive work of the northern bank of the pit using a fan shaped advance of the mining operation front; create a mining operation front for bed 4 and intensive advance until it merges with the turned working bank of the active pit.

At sinking rates of 15 meters annually at sections 4 and 11, depending upon mining engineering conditions loading amounts to 3,700 tons per meter of annual mining front advance. Annual productivity reaches 11,1 million tons of coal on a 3 km long front. Thus, the development of mining operations using the planned technology requires 14-15 years to reach a working depth of 200 meters.

The implementation of these measures to develop mining operations directed towards the efficient working of the entire deposit (the possibility of moving large volumes of overburden rock over the shortest distance in the excavated area), requires capital investments for the construction of rail lines, sloped shafts, conveyors, tunnels, transverse trenches and cutting through horizons. It is therefore necessary to determine the economic effectiveness of these investments.

The reduction of transportation outlays and the use of the nontransport method will result in considerable savings of operational expenditures. The reduction in transportation outlays is due to a 3-4 fold reduction in hauling distance and the length of rail lines when internal spoils banks are created. The savings are on the order of 15-20 kopecks per cubic meter of rock hauled. Studies show that throughout the entire period of working the deposit

up to 13 billion cubic meters of overburden rock will be hauled to the internal spoils banks, making it possible to save 1.8-2.6 billion rubles. Using the nontransport system for overburden rock reduces prime cost by 25 kopecks compared to the transport system, yielding an annual savings of 5 million rubles.

The study of mining operations at the Ekibastuz deposit shows the possibility and necessity of more rationally working beds 1, 2, 3 and 4 and of organizing internal spoils banks. Such measures will result in: a reduction in haulage distance to 5 km compared to 12-25 km; the flow line movement of locomotives and rolling stock will be organized and mining-transportation equipment productivity will improve; a reduction in the length of rail lines and the amount of track laying and repair work; increased pit productive capacity; ensured independence (lack of rigid linkages) for conducting work on bed 4 in the initial period at sections 5 and 6; reduction in the probability of damage to stationary banks at pits; ensure the more complete extraction of coal reserves and improve the basin's ecology. The annual economic effect will amount to around 20 million rubles.

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11,574
CSO: 1822/332

COAL

MINE BRIGADE COMPLETES PLAN AHEAD OF TIME

Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 18 Aug 83 p1

[Excerpts from article by V. Mikhaylichenko: "Difficult Heights"]

[Excerpts] Upon coming up to the surface they immediately fell into the arms of their work comrades, there were greetings, flowers and music. The miners held a chunk of coal with the number 1,904,000.

This is the amount of coal extracted since the beginning of the five-year plan by the brigade of A. Kolesnikov, Hero of Socialist Labor and member of the CPSU Central Committee, which has fulfilled the three years' plan ahead of time. The coal masters were congratulated for this great achievement by the entire collective of the Molodogvardeyskaya Mine in the Krasnodonugol' [Krasnodon Coal] Production Association.

The unexpected displacement of the bed and the caprices of the unstable roof forced the collective to avoid large losses and promptly search for a new way to organize work. Instead of the usual one combine at the longwall, two were immediately put into operation, one on the upper and one on the lower part. This justified itself completely. As a result the average indicator of daily extraction even on the most strained days exceeded 1,500 tons.

The brigade was able to test new technology, help plant specialists and workers improve it and increase its operational reliability. The IUKP experimental complex recently passed a test at the longwall where A. Kolesnikov's detachment works. It demonstrated a number of undoubtable advantages.

Today is January 1984 on the work calandar of Kolesnikov's brigade. The loading at the longwall has increased to 2,152 tons per day. This is considerably greater than the plan and double the figure for the oblast's highly productive extraction brigades.

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CSO: 1822/344

COAL

SYNOPSIS OF SELECTED ARTICLES IN UGOL' UKRAINY, JULY 1983

Kiev UGOL' UKRAINY in Russian No 7, Jul 83 p 48

UDC 622.232.83

TUNNELING EQUIPMENT OF THE YASINOVATAYA MACHINEBUILDING PLANT

[Synopsis of article by M. D. Trutsunenko, UGOL' UKRAINY, No 7, 1983 pp 3-5]

[Text] Machinery and equipment produced by the Yasinovataya Machinebuilding Plant imeni 60-Letiya SSSR. Plans and prospects. 6 illustrations.

UDC 658.52.011.56:622-52

IMPROVEMENT OF AUTOMATION EQUIPMENT AT KONOTOP ORDER OF LABOR RED BANNER PLANT 'KRASNYY METALLIST'

[Synopsis of article by V. A. Denyak, UGOL' UKRAINY, No 7, 1983 pp 6-9]

[Text] The plant's work to improve automation equipment and instruments for work safety for the coal industry. Problems connected with satisfying this output. 7 illustrations.

UDC 622.233.05

NOVAYA GORLOVKA MACHINEBUILDING PLANT

[Synopsis of article by B. I. Mayboroda in UGOL' UKRAINY, No 7, 1983 pp 10-11]

[Text] Problems of the collective of the Novaya Gorlovka Machinebuilding Plant, which produces equipment. The most immediate tasks. 2 illustrations.

UDC 622.33.002:658.277

RESTRUCTURING OF MINING ACTIVITY IN UNDERGROUND MINES IS BASIS FOR EFFECTIVE USE OF HIGHER-LEVEL EQUIPMENT

[Synopsis of article by S. A. Saratikyants in UGOL' UKRAINY, No 7, 1983 pp 12-14]

[Text] Results of work to create new coal-mining machinery; basic areas for improving mining activity. 3 illustrations.

UDC 622.33.69.05.001.5

RESULTS OF AND PROSPECTS FOR WORK BY 'VNIIOMSHS'

[Synopsis of article by O. S. Dokukin in UGOL' UKRAINY, No 7, 1983 pp 15-17]

[Text] Work by VNIIOMSHS [All-Union Scientific-Research Institute for the Organization and Mechanization of Underground-Mine Construction] to create and modernize new machinery and mechanisms for mining and underground-mine construction work. Promising research to solve problems of raising the technical level of underground mine construction. 5 illustrations.

UDC 622.268.13 "sh. Tsentral'naya"

WORK EXPERIENCE OF A. G. DUDIN'S TUNNELING BRIGADE

[Synopsis of article by N. M. Dol'nikov in UGOL' UKRAINY, No 7, 1983 p 18]

[Text] On the work of A. G. Dudin's tunneling brigade from the Tsentral'naya Underground Mine of the Antratsit Association. Work organization and technical and economic indicators. 1 illustration.

UDC 621.515 "sh. Krasnoarmeyskaya"

TURBOCOMPRESSOR OPERATION AT KRASNOARMEYSKAYA HYDRAULIC UNDERGROUND MINE

[Synopsis of article by B. P. Franks, V. A. Kharaman and M. N. Fedorushchenko in UGOL' UKRAINY, No 7, 1983 p 19]

[Text] The operation of air turbocompressors. Elimination of their defects.

UDC 622.831.322.812:553.081.4.311

EFFECT OF METHODS FOR PROTECTING MINE WORKINGS DURING MANIFESTATIONS OF BLOW-OUT HAZARDS OF COAL SEAMS

[Synopsis of article by V. A. Yudkovskiy in UGOL' UKRAINY, No 7, 1983 pp 20-21]

[Text] Rational methods for protecting developmental tunneling and the area of their use at seams subject to blowouts. 2 tables, 1 reference.

UDC 338.60:622.33.012.22

ON EVALUATING DEEP-MINE OPERATING EFFECTIVENESS

[Synopsis of article by A. I. Zemlyankin and Ye. N. Bogatko in UGOL' UKRAINY, No 7, 1983 pp 22-23]

[Text] The use of provisionally equated expenditures for evaluating the operating effectiveness of deep underground mines. An analysis of the coefficients of restoration, retirement and wear of fixed production capital during the Ninth and 10th Five-Year Plan. 1 table, 5 references.

UDC 622.01.5:622.26.003.12

EFFECT OF EXPENDITURES STRUCTURE ON WORK EFFICIENCY OF TUNNELING CUTTER-LOADERS

[Synopsis of article by V. A. Karmazin in UGOL' UKRAINY, No 7, 1983 pp 24-25]

[Text] The influence of the equated expenditures structure and of elements thereof on choice of rational speeds of mine-face advance and on the use effectiveness of use of cutter-loaders in development tunneling. 4 illustrations.

UDC 622.26:551.112

EFFECT OF IMPREGNATING ROCKS WITH CHEMICAL SOLUTIONS ON EFFICIENCY OF TUNNELING

[Synopsis of article by N. I. Shcherbak in UGOL' UKRAINY, No 7, 1983 pp 25-26]

[Text] The technology and means for impregnating rock with chemical solutions. Preliminary impregnation of rock with chemical solutions and later blasthole destruction of the rock body, and the effectiveness of mine-tunneling operations. 2 illustrations.

UDC 622.01:624.191.5

CAPITAL-INVESTMENT EFFECTIVENESS IN UNDERGROUND-MINE CONSTRUCTION

[Synopsis of article by B. V. Grimm in UGOL' UKRAINY, No 7, 1983 pp 27-28]

[Text] The potential for increasing capital-investment effectiveness in underground-mine construction.

UDC 622.33.012.2:69.05

ON INTEGRATED OPTIMIZATION OF PLAN FOR ORGANIZING CONSTRUCTION OF AN UNDERGROUND MINE

[Synopsis of article by L. P. Kogan, V. Ye. Morozov and A. M. Karlash in UGOL' UKRAINY, No 7, 1983 pp 29-30]

[Text] The essence of an integrated approach to the design of an organization for building an underground mine. A consideration of resource limitations while forming the organization for erecting an underground mine. The methodology for the integrated step-by-step design for the organization of construction. Requirements for the overall organization of design work. Area of use of the methodology. 1 illustration, 1 reference.

UDC 658.314.72:622.01 "Makeyevshakhtostroy"

ON TECHNICAL CREATIVITY IN MAKEYEVSHAKHTOSTROY TRUST

[Synopsis of article by A. S. Shul'ga in UGOL' UKRAINY, No 7, 1983 p 30]

[Text] The results of rationalizers' work in Makeyevshakhtostroy [Makeyevka Underground Mine Construction Trust] during the 10th Five-Year Plan and the first 2 years of the 11th. Measures that provide for stable and high indicators for inventiveness and rationalization.

UDC 622.831:552.1.531

STUDY OF EFFECTIVE SURFACE ENERGY OF ROCKS, IMPROVEMENT IN FORECASTING BLOW-OUT HAZARD

[Synopsis of article by A. D. Alekseyev and N. A. Ryazantsev in UGOL' UKRAINY, No 7, 1983 pp 31-32]

[Text] Results of research of amount of effective surface energy (EPE) of sandstones and industrial tests of methods for forecasting the extent of blow-out risk with respect to EPE. 1 illustration.

UDC 622.807:621.694.2

WATER-AND-AIR EJECTORS FOR CLEANING DUST, AIR FLOWS IN MINE WORKINGS

[Synopsis of article by A. D. Buyanov, G. V. Tsyperovich and M. I. Fes'kov in UGOL' UKRAINY, No 7, 1983 pp 32-33]

[Text] Short analytical study of two-stage ejectors with two nozzles placed consecutively along the axes for double pulverizing. 1 illustration.

UDC 622.007

ON A POWER-SUPPLY MODE FOR UNDERGROUND MINES

[Synopsis of article by M. V. Popov in UGOL' UKRAINY, No 7, 1983 p 33]

[Text] Proposals for rational power supply for mines engaged in underground operations. 1 table.

UDC 622.678:525

SUSPENDED 'UP' STRUCTURES FOR CAGES FOR SINGLE-CABLE LIFTING

[Synopsis of article by V. I. Bondarenko, A. I. Solomentsev and V. G. Belikov in UGOL' UKRAINY, No 7, 1983 pp 34-35]

[Text] Design features of suspended installation and ring and the operation thereof in a coal-mine environment. 1 table, 2 illustrations.

UDC 622.783.8(088.8)

RISE IN QUALITY OF LINING OF UNDERGROUND-MINE HEADFRAME PULLEYS

[Synopsis of article by V. A. Ivanov and V. N. Petrina in UGOL' UKRAINY, No 7, 1983 pp 35-36]

[Text] The results of a study of industrial tests of lining that has been strengthened (according to a technology that has been developed) and of ordinary lining. 1 illustration.

UDC 621.336.315 "sh. Ukraina"

USE OF ROLLER-TYPE CURRENT COLLECTOR AT UKRAINIA UNDERGROUND MINE

[Synopsis of article by V. P. Zhuravskiy and A. M. Kravets in UGOL' UKRAINY, No 7, 1983 p 36]

[Text] Installation and operating principle of the R-133 slip ring. 1 illustration.

UDC 622.285:622.414.2

EFFECT OF INCREASE IN OPPOSITION TO METAL INTENSIVENESS OF POWERED MINE SUPPORTS

[Synopsis of article by Yu. A. Litvyak and Yu. N. Zheludkov in UGOL' UKRAINY, No 7, 1983 p 37]

[Text] Analysis of domestic and foreign powered mine supports. 3 illustrations.

UDC 622.002.56:621.385.2-768.3

ARRANGEMENT FOR SPARK PROTECTION FOR 'AC' CIRCUITS OF INCREASED POWER

[Synopsis of article by E. G. Kogan, B. F. Lakhmanov and S. V. Mamchenko in UGOL' UKRAINY, No 7, 1983 pp 37-38]

[Text] Ways to increase the spark-safety capacity of inductive AC circuits. Operating principle of a controlled installation for spark protection. 1 illustration.

UDC 622.929:622.01

VACUUM-GASLIFT SYSTEM FOR REMOVING ASH, SCRUBBING GASES OF UNDERGROUND-MINE BOILERROOM

[Synopsis of article by V. B. Gogo in UGOL' UKRAINY, No 7, 1983 p 38]

[Text] Scheme for a vacuum-gaslift system that enables transporting of ash and slag waste and cleaning of stack gases of an underground-mine boilerhouse to be combined. 1 table, 1 illustration, 1 reference.

UDC 622.765.061.22:615

TOXICOLOGICAL PROPERTIES OF APOLAR COLLECTOR REACTANTS FOR COAL FLOTATION

[Synopsis of article by V. M. Nazarenko and Ye. Ye. Mogilevskaya in UGOL' UKRAINY, No 7, 1983 pp 39-40]

[Text] Toxicological and sanitary-hygiene features of AAR-1 and AAR-2 flotation collector reactants, which are used widely at coal preparation plants. 2 tables, 1 reference.

UDC (550.8:528.3):553.94.004.12:622.01

ON EVALUATION OF RANDOM CHANGEABILITY, GEOMETRIZATION OF COAL SEAM ASH CONTENT

[Synopsis of article by K. L. Semenov and L. D. Bogacheva in UGOL' UKRAINY No 7, 1983 pp 40-41]

[Text] Random fluctuations of coal-seam ash content as a function of order of magnitude of ash content. Practical ways for increasing the precision of geometrization of coal-seam characteristics during exploration. 1 table, 2 illustrations, 3 references.

UDC 622.834:622.27.001.5

SHIFTING OF EARTH'S SURFACE ABOVE WORKINGS OF OLD DONBASS MINES

[Synopsis of article by S. A. Medyantsev in UGOL' UKRAINY, No 7, 1983 pp 41-42]

[Text] The height of the spreading of caving of a rockmass above the development workings of old mines. The depth, less than which the cleared workings of old mines that are preserved present a danger to surface structures. 1 illustration.

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CSO: 1822/306

COAL

BRIEFS

MINING COMPLEX -- A new mining complex created by specialists from the Ekibastuz-ugol' [Ekibastuz Coal] Association and Donetsk machine builders will help accelerate and reduce the costs of work face preparation for powerful rotary bucket excavators. The complex includes a rotary excavator with a productivity of 1,000 tons of coal per hour and a belt reloader. In 1 hour this unit can move 1,600 cubic meters of coal or rock 50 meters and lift it 20 meters. The complex was tested at the Bogatyr' Strip mine. The introduction of such units will make it possible to remove low productivity single bucket excavators from the cuts of new horizons and considerably accelerate the preparation of coal faces. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 Jun 83 p 2] 11,574

NEW MINE -- Kirghiz geologists have transferred to industrial operation the first section of the new promising Kara-Tut coal deposit. Extraction here will be by the surface mining method, the most economical. B. Kamashev, department chief of the Kirgiz SSR Administration of Geology explained that the exploration of this deposit is continuing. According to preliminary data, total reserves here are around 30 million tons. Initially, the new mine will be able to produce up to 100,000 tons of fuel annually. Later its capacity will double. During operations rock will not have to be hauled to a special spoil bank, as it will be used to fill up worked out areas. The Kara-Tut deposit supplements the raw material base of coal strip mines at the Tash-Kumyr Mine Administration. Reserves at the operating Tegeneka and Kara-Su are gradually being exhausted, therefore the operational introduction of the new enterprise will make it possible to keep coal extraction at its previous level. Next is the development of yet another, larger deposit -- Kumbel'skoye -- where extraction will also be by the surface method. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 21 Aug 83 p 2] 11,574

MINERS COMPLETE PLAN -- The collective at the Kommunist Mine of the Oktyabr'ugol' [October Coal] Production Association completed the target for coal extraction during three years of the five-year plan. Since its beginning more than 400,000 tons of coal above the plan have been mined and shipped to customers. The labor productivity growth target was overfulfilled by 9 percent. Two million rubles have been saved through reductions in coal prime cost. [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 4 Aug 83 p 1] 11,574

QUARTERLY PLAN AHEAD OF TIME -- Miners at the Mine imeni Gor'kiy, Donets Coal Production Association were the first miners in the oblast to report the fulfillment of the quarterly coal extraction plan. Since the year's beginning customers have been shipped 50,000 tons of above-plan coal. There are no lagging sections or brigades at the mine. Every day 400 - 500 tons of fuel more than the established program are sent to the surface. The greatest successes here have been attained by collectives in the first and twelfth sections, headed by V. Vydrenkov and V. Boyko. [By G. Dorofeyev] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 24 Jun 83 p 2] 11,574

OVERFULFILL PLAN -- Donetsk, 21 February. The millionth ton of coal obtained above the plan arrived at the surface today, lifted by miners at the Donets Coal Production Association. This was the result of competition which developed two years ago on the eve of the 26th CPSU Congress. Its initiators were delegates to the party forum from the Donbass who decided to work in such a manner that their neighbors would also labor like shock workers. The rivalry was led by tunnel drivers preparing the work fronts for coal extractors. Twenty brigades, successfully mastering the equipment which had arrived at the mine, doubled the established pace for tunnel driving. Workers of workface collectives picked up the baton of the underground racers. Twelve of them surpassed the 1,000 ton per day mark from 1 longwall. Many of them, working thin seams, produced 500 tons per day. The extractors were helped by transport workers, speeding up freight movements on the underground routes; and by mechanics, who ensured the continuous operation of mining machinery. The common efforts of people in various professions, based on strict discipline and exemplary order at each work site, helped the largest association in the Donbass get two weeks ahead of the extraction work schedule. [By B. Gertsenov] [Text] [Kiev PRAVDA UKRAINY in Russian 22 Feb 83 p 1] 11,574

VOROSHILOVGRAD MINES -- At the Stakhanovite Mine imeni Chesnokov the competition is led by the brigade of Aleksey Orel. Working in difficult geological conditions, it daily produces 80 - 100 tons of coking coal above the plan. Since the year's beginning the collective has sent up 3,000 tons of fuel in addition to the program and has gained an entire week. Firm labor and production discipline, efficient mining operations, excellent management of equipment and complete interchangeability help the units of Yuriy Dryagin, Gennadiy Chaliy, Viktor Chobotok, Ivan Neshcheret and Pavl Safronov maintain fast work rhythms. [By A. Lukash] [Text] [SOTSIALISTICHESKAYA INDUSTRIYA in Russian 25 Mar 83 p 1] 11,574

KEMEROVO AUTOMATION -- The first automated line for the manufacture of metal arch supports for coal mines in the Kuzbass has started up at the South Kuzbass Coal Association. This year at the Osinniki electromechanical shops at least 20,000 sets of supports will be produced. This is enough for almost 24 kilometers of tunnels. Only three operators will control the line. According to designers' calculations the line will be paid off in the first half year of operation. [By V. Kladchikhin] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 14 Aug 83 p 2] 11,574

UFA MINE -- The first section of a new strip mine, which will produce one million tons of coal annually, went into operation at the Bashkir Coal Association. This coal is formed into briquets and shipped to several oblasts to be used as household fuel. This year the second section goes into operation. It has a capacity of 2.5 million tons annually. [By A. Zinov'yev] [Text] [Moscow IZVESTIYA in Russian 8 Apr 83 p 1] 11,574

MINERS' RECORD -- A record for daily coal extraction has been set by the comprehensively mechanized brigade of A. Nikitin at the Nagornaya Mine in Novokuznetsk. The miners extracted 5,100 tons from a comprehensively mechanized longwall, double the daily plan. The collective presented this labor gift to brigade leader and Hero of Socialist Labor Aleksandr Fedorovich Nikitin on his 50th birthday. The notable brigade leader is one of the initiators of mechanized coal extraction in the basin. Now the brigade is mastering the new Kusheyakovskoye deposit. Here the Nagornaya miners, using their own resources, have built a full cycle process system from longwall to railroad car loading. This year they plan to extract at least 800,000 tons of coal here. [By V. Kladchikhin] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 38 Mar 83 p 1] 11,574

EKIBASTUZ WINNERS -- Pavlodar -- The highest productivity in the Ekibastuz Coal Association was attained by the brigade of A. Shishlov, winner of the USSR State Prize in 1982. It loaded 700,000 tons of coal, including 50,000 above the plan, from the work face. Working on the nation's most powerful rotary bucket excavator, capable of extracting 5,000 tons of fuel per hour, the progressive collective is modernizing its components and increasing its productivity. Jointly with specialists from the Novokramatorsk Machine Building Plant, the miners have made efficient changes in the machine's running gear. The main coal conveyor has become more reliable and the energy system, which was a vulnerable component last year, has been completely modernized. A. Shishlov said that their excavator, with the first plant number, was an experimental machine. During the course of operation they discovered its additional potentials. Making use of them, the brigade resolved to increase the giant's annual production to 10 million tons by the end of the five-year plan. This is almost two million tons higher than the sector's record, set by this collective a year ago. [Text] [Alma-Ata KAZAKHSTANSKAYA PRAVDA 12 Feb 83 p 1] 11,574

TULA MINES -- The collective of the Podmoskovnaya Mine, Novomoskovsk Coal Association has, since the beginning of the year, produced 45,000 tons of coal in addition to the program. Four sections in the mine produce at least 1,000 tons a day. Podmoskovnaya miners have now entered a shock labor watch to complete the half-year target ahead of schedule. The first to report plan fulfillment was the fourth section, headed by A. Titov. Since the beginning of the year it has extracted more than 260,000 tons of coal. The section collectives headed by Yu Yamov, Ye. Boldyrev and M. Koryakin are close to over-fulfilling the half-year plan. [By E. Mokhorov] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 25 Jun 83 p 1] 11,574

KANSK-ACHINSK TECHNOLOGY -- The creation of a waste free technology for preparing brown coal from the Kansk-Achinsk deposit is the main task of the

"Energiya" comprehensive targeted program. Researchers from 23 of the largest VUZes in the RSFSR are involved in its realization. Commenting upon it, the deputy to its scientific manager, Professor V. A. Proskuryakov, rector of the Technological Institute imeni Lensoviet, reported that the "Energiya" program is to last five years and intends to simultaneously develop efficient methods of burning fuel and transmitting the electrical energy of the Kansk-Achinsk Fuel and Energy Complex. Specialists the the Polytechnical Institute in Leningrad have already found the most optimal variant for furnace design, reducing steam generator size by one-third and increasing their reliability and longevity. At an experimental test site specialists have begun to test the most important elements of a 1,800 kilowatt electric transmission line. They feel that such a line will be the most promising for transmitting energy to the center of the nation. [By LenTASS] [Text] [Leningrad LENINGRADSKAYA PRAVDA in Russian 31 Jul 83 p 1] 11,574

NOVOKUZNETSK MINES -- Miners at the South Kuzbass Coal Association have produced their 1 millionth ton of coal above the plan since the beginning of the five-year plan. The right to extract it was won by P. Frolov's brigade from the Raspadskaya Mine. Rhythm is the main feature of work at one of the nation's largest coal associations. For the past year and a half miners have been fulfilling the plan from month to month. This is attained through improving work organization and introducing progressive technology. There have also been improvements in the quality of engineering solutions to the preparation of new reserves for extraction: each new longwall contains 60,000 tons of coal more than those at the beginning of the five-year plan. Basic pay scale is based on brigades extracting 1,000 tons. Fourteen of them are extracting 500,000 tons and more coal annually, while the brigades of P. Frolov, V. Devyatko and M. Reshetnikov are planning to extract 1 million tons each. [By V. Kladchikhin] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 22 May83 p 1] 11,574

PAVLODAR AHEAD OF PLAN -- Miners at the Mine imeni 26th CPSU Congress, Pavlodar Coal Association were the first in the western Donbass to complete the program for the first three years of the five-year plan ahead of time. They sent up more than 3.5 million tons of coal. To attain this they worked on an accelerated schedule, making it possible to put almost 500,000 tons on the above-plan account. All the sections and services in the enterprise are working smoothly. For more than 10 years now they have consistently fulfilled annual plans and socialist obligations. The fourth and sixth sections are moving forward, they are headed by Ivan Voytovich and Vasiliy Kovalenko, winners of USSR State Prizes. The miners are working coal seams down to one meter thick and the large amount of water forces them to take additional measures and to create a special drainage system so that water does not flow onto the face. In spite of this daily loadings from the longwall are growing and constantly exceed planned indicators. [By V. Pryadko] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 31 Jul 83 p 1] 11,574

MINERS' DAY -- Leninsk-Kuznetsk (Kemerovo Oblast. The collective at the Mine imeni Yaroslavskiy attained the best results in the competition to properly celebrate the professional holiday, Miners' Day, at the Lenin Coal Association. Since the year's beginning miners here have put more than 170,000 tons of fuel on the above-plan account. More than one-third of all above-plan extraction

is accounted for by N. Bazhenov's mechanized coal removal brigade, which is well known in the Kuzbass. For the city's miners Miners Day will be a double holiday; the oldest mine in the Kuzbass, the Leninskiy, is 100 years old. During its century of operation the mine has produced more than 500 million tons of excellent coal. The collectives at the Kol'chuginskaya, imeni 7 November and Kuznetskaya Mines are honorably celebrating the glorious labor traditions.

[By A. Bogachuk] [Text] [Moscow PRAVDA in Russian 15 Aug 83 p2] 11,574

SHAKHTERSK RESULTS -- The collective at the Vinnitskaya Mine, Shaktersk Anthracite Association, was the first among Ukrainian coal miners to meet the coal extraction target for three years of the five-year plan. In 2.5 years customers have been shipped almost 280,000 tons of coal in addition to the plan. About two kilometers of tunnels more than planned have been driven. Working with precise rhythm, miners have improved all techno-economic indicators. Labor productivity has increased by 25 percent and coal prime cost per ton has been reduced considerably. More than three million rubles have been saved since the five-year plan's beginning. [By G. Dorofeyev] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 20 Jul 83 p 1] 11,574

COAL CONVEYOR -- Hundreds of railroad cars and large trucks will be replaced by the conveyor which will link together the most important projects at the Kansk-Achinsk Fuel and Energy Complex -- the Berezovskiy-1 Strip Mine and the first Berezovskaya GRES. Installation work has begun on this unique road for coal. Every day this gigantic transportation system will bring 100,000 tons of fuel to the thermal power plant. Its high speed delivery -- 4.6 meters per second -- will help ensure the reliable operation of the GRES. The closed gallery enclosing both belts improves the coal highway's safety and reliability. [Text] [Moscow SOVETSKAYA ROSSIYA in Russian 2 Aug 83 p 1] 11,574

SUPER DEEP WELL -- The drilling of the first super deep well in the Kuzbass has begun in Belovskiy Rayon. It will penetrate more than 3,000 meters into the depths of the earth. The first few hundred meters have now been drilled. The well is intended for data collection on the presence of gases in the earth's lower strata. Such information will help the designers and builders in the creation of optimal ventilation systems for new mines and will improve coal extraction safety. [By V. Andreyev] [Text] [Moscow SOVETSKAYA ROSSIYA in Russian 18 Aug 83 p 1] 11,574

ABOVE PLAN COAL -- A. Belousov's brigade at the Miusinskaya Mine is confidently leading in competition at the Donbass Anthracite Production Association. In just a few days this collective will be extracting coal on the 1984 account. The thin seam that the brigade is mining is no hinderance to attaining high indicators. The miners daily produce up to 1,000 tons, significantly more than the plan. During January - May they exceeded the target by 30,000 tons and since the beginning of the five-year plan they have put 200,000 tons of anthracite on their above-plan account. Miners in Section No 2 at the Mine imeni 26th CPSU Congress, Roven'ki Anthracite Production Association have also begun to work on the labor calandar's fourth year of the five-year plan. The brigade of coal removal face workers led by V. Kolesnikov made the greatest contribution to the success. [By V. Mikhaylichenko] [Text] [Moscow SOTSIALISTICHESKAYA INDUSTRIYA in Russian 5 Jun 83 p 1] 11,574

NUCLEAR POWER

REVIEW OF BOOK ON REGIONAL POWER DEVELOPMENT

Moscow PLANOVYE KHOZYAYSTVO in Russian No 8, Aug 83 pp 117-118

[Review by A. Beschinskiy, doctor of economics, of book "Regional'nyye problemy Razvitiya Energetiki i Elektrifikatsii" ["Regional Problems in the Development of Power Engineering and Electrification"] by V. A. Ryl'skiy, Ekonomika, Moscow, 1981, 168 pages]

[Text] This book poses a number of important problems in the development of electrification and the location of power engineering operations in the nation. It studies the territorial aspects of this problem's development. The book is distinguished by a comprehensive approach to the problems examined.

The author systematically applies fruitful methodological concepts concerning a region's energy-economic characteristics. In his opinion, during the evaluation of power engineering, especially electrical, development it is essential to trace, and if possible to include in the study the technical and economic results from the more extensive introduction of electrical energy in the consuming sectors.

The work gives special attention to problems in the formation of the fuel-energy needs of regions in the nation's European sections. It is shown that the growth in energy demand in these regions is not due to energy intensive production operations, but to sectors producing output of a mass nature, primarily machine building and ferrous metallurgy. It is the author's opinion that in the foreseeable future the development of nuclear energy in the European sections of the USSR cannot decisively reduce the growth in demand for fuel and energy resources, in particular because nuclear power plants only cover a small share of electrical energy demand.

The work stresses the relationship of electrification to the technical levels of production. In examining the significance of the energy factor in the location of productive forces, V. A. Ryl'skiy expresses the necessity of a regional approach to electrification levels and the presence of objective conditions for expanding the use of electrical energy and increasing the electrical energy per worker, especially in labor short regions (Siberia and the Far East). This is reflected in recommendations for the more rapid development of electrical steel production in Siberia, increased levels of electrical mechanization and electrification in these regions and the location of electricity intensive industry here.

The book provides a detailed examination of the feasibility and practical implementation of optimal electrification levels in the nation's various regions.

The author speaks out against using long-run marginal costs [zamykayushchiye zatraty] for fuel and electrical energy when comparing variants for the location of productive forces. He bases this on the heterogeneous composition of completion costs for various regions and on changes in the "accounting situation" in view of the great influence of national economic development parameters on the economics of the fuel-energy bases in different regions and on changes in the scales in energy consumption (p 23). He presents the interesting, but disputable thesis on the unsuitability of using completion costs in calculations to determine the efficiency of alternatives for locating productive forces. It should be verified. In particular, this applies to the degree of completion costs' stability relative to conditions of their use.

It stands to reason that completion costs should not be used for the optimization of general schemes for production location and development, because their magnitude should be determined as a result of this optimization. Consequently, all types of fuel here should be included at their direct costs. However, in our opinion, the completion costs obtained from energy operation optimization in general could be used in solving more specific problems, for example, the location of enterprises or enterprise complexes in various sectors.

The author offers a model for estimating the efficiency of electrification in a regional perspective. He is justifiably critical of the contemporary practice of deriving energy resource consumption structure as the sum of sectorial ministry demand.

The book has a detailed study of problems in building models for electrical energy development. Problems in the territorial organization of heat supply systems are studied. It gives consideration to a number of factors in system formation: production sectorial structure, scales of concentration which determine heat supply load concentration and density and consequently rational scales for central heat supply development.

The book contains a quite sufficient evaluation of regional tendencies in the development of power engineering (Chap. 2). However, a number of points are doubtful. Particularly disputable is the proposal to create energy intensive production complexes based upon nuclear power plants in the northern areas of the European part of the USSR and the Serginsk Complex of power stations. In our opinion, the author's techno-economic comparison of energy supply alternatives in the Urals and the Middle Volga, presented on page 113, should be supplemented by a comparison of gas fired power plants with nuclear plants. Finally, his position on the advisability of energy and capacity flows from the Kansk-Achinsk Fuel-Energy Complex (KATEK) to the European parts of the nation should be verified. Such a possibility will determine the role of the complex in Siberia's future energy balance. On the other hand, the solution to this problem will be influenced by the scales of nuclear power development in energy scarce regions, AES economic indicators, operating characteristics of future electric power transmission lines [LEP] and the possibility of using the main KATEK LEPs to optimize the operating conditions of generating capacity in the European and Siberian sections of the USSR's Unified Energy System.

In our view, the author somewhat underestimates nuclear energy's role in the location of production operations in the European regions of the nation. Its significance in the energy balances of these regions will grow ever greater due to the intensive use of nuclear energy not only for electricity production, where the entire growth in the base load of the energy system will be covered by nuclear power plants, but also for thermal energy. Nuclear energy's share is increasing sharply and it is beginning to dominate the incremental increases in the future energy balance. Nuclear power plants require maximum stability in operating conditions. Therefore during load drops they become inexpensive energy, valued according to the fuel component of outlays.

The author justifiably stresses the necessity of pace setting development rates in the eastern regions, in particular through the location there not only of highly energy intensive industry, but also of average energy intensive enterprises within the framework of the TPK [Territorial production complexes] being formed there, including those in ferrous metallurgy, machine building and chemicals. At the same time, he somewhat one sidedly views this process as the most realistic direction for reducing the European regions' dependence on fuel deliveries from the eastern regions (p 18).

The relationship in the scales of energy consumption in the nation's western and eastern regions is the result of optimizing a large number of factors, including further growth in the European areas' production potential based on the reconstruction and modernization of existing equipment, the balances of capital investments and labor, and policies on energy conservation and replacing liquid fuel with other energy sources.

While stressing the interesting and thorough analysis of regional energy problems, it should be noted that with regard to the European regions the author did not emphasize the acute necessity of sharply increasing the flexibility of power engineering equipment and related operating condition requirements for deliveries of certain types of fuel.

These comments do not belittle the overall positive evaluation of the book. It is practically the first study of regional problems of electrification and one of the first on the regional problems in the development of power engineering operations..

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CSO: 1822/335

NON-NUCLEAR POWER

SHORTAGES OF MANPOWER, CONSTRUCTION MATERIALS AT PERM GRES

[Editorial Report] PM211310 Moscow PRAVDA in Russian 12 October 1983 First Edition publishes on page 2 under the rubric "On the Map of Construction Projects" a 1,200-word report by Correspondent S. Ryabov entitled "Trust and GRES." The report tells how the commissioning of Perm GRES has already had to be deferred more than once and how it is unlikely that it will be finished by the revised deadline of next year. The basic reason is a shortage of manpower resulting from the lack of accommodation for workers, which in turn is a consequence of a shortage of construction materials. Equipment for the new power station is already being delivered to the site, but there is reportedly nowhere to store it under cover. The correspondent writes that "this issue has repeatedly been examined by the Power and Electrification Ministry collegium and at various sessions, but to no avail." In the spring of last year the leaders of the organizations involved promised to rectify the situation, but "there have been no particular changes for the better." The report concludes as follows: "Do the GRES construction workers have any possibility of breaking the 'vicious circle' and handing over the first stage of the station on schedule? Above all, the leaders of the USSR Power and Electrification Ministry must answer this question. The minister, P. Neporozhniy, came to the laying of the station's foundation stone. But a similar visit today would be still more useful. It is time the sector's headquarters took a self-critical look at the situation in which the energy complex finds itself, analyzed its troubles, and took measures to make the pulse of the important construction project beat evenly and reliably."

CSO: 1822/33

PIPELINE CONSTRUCTION

UDC 658.001.54:658.004.5:658.004.67

SYSTEM FOR REPAIRING, MAINTAINING PIPELINE-BUILDING EQUIPMENT REVISED

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 7, Jul 83 pp 2-4

[Article by V. Ye. Lapshin, Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises]: "The Mechanization of Construction and Improvement in the Use of and Repair Support for Equipment"]

[Text] In 1981-1985 the ministry's construction organizations are to do 6 billion rubles' worth of construction and installing work more than was done during the 10th Five-Year Plan. The length of 1,420-mm diameter pipeline will be doubled. A total of 56,000 km of gas, oil and product pipelines will be put into operation, or about 100,000 km if pipelines at the fields are included.

One of the basic and decisive elements in Minneftegazstroy's execution of the large and complicated construction program that is planned for the 11th Five-Year Plan is that of increasing labor productivity, which will be provided for by the wide introduction of highly productive construction and transporting equipment, highly industrialized constructional structure, effective materials, progressive methods for performing construction work, and advanced ways of organizing the work. It is planned that more than half the increase in the construction program will come from increasing the integrated mechanization of labor-intensive processes, further expanding outfitted-module construction and improving the technology for and organization of operations. These tasks can be fulfilled by providing construction organizations with high-powered equipment.

As a result of the constant attention given by the CPSU Central Committee and the USSR Council of Ministers to questions of boosting the development of combustion-type power engineering, primarily the gas industry, the ministry's construction organizations are receiving highly productive equipment for carrying out the construction and installing program, which will enable a buildup in capacity for the recovery and transport of oil and gas. The CPSU Central Committee decree about reequipping the industry with machinery was aimed at creating the appropriate technical and economic potential for successful execution of 11th Five-Year Plan tasks. The set of measures for reequipping Minneftegazstroy construction organizations includes:

augmentation of the fleet of construction and transporting equipment, mainly with equipment of higher power and productivity that is suitable for operation in the North and in swampy places;

improvement in the use of construction machinery and special transport equipment by converting heavy construction equipment and machinery to two-shift operation and by elevating the operational readiness factor of the fleet of machinery and transport equipment to 0.8-0.85;

a rise in the use of automatic pipeline-welding methods on the lines to 70 percent of all welding operations, with 100-percent monitoring of welded-joint quality;

a 1.5-fold rise in the productivity of the spreads during construction of the linear part of pipelines 1,220 mm to 1,420 mm in diameter by 1985;

still greater improvement of the outfitted-module method of building surface facilities, with a view to reducing 1.5-fold to 2-fold the standard periods for erecting them; and

further improvement of the organization and the system for controlling construction operations.

Realization of the program for technical reequipping has enabled the branch to increase the power-worker ratio to 33.7 kW per worker, or to 48.9 kW for pipeline organizations, and it has also enabled the spreads, including the subunits that perform site preparation, to be completely outfitted with highly productive equipment for pipeline construction.

An increase in the use of powered equipment, combined with measures for improving the structure of construction organizations and the organization of construction, has enabled spread productivity to be increased: it was an average of 71 km for 1,420-mm diameter pipeline construction in 1981, 104 km in 1982.

The ministry's design-development organizations have developed and machine-building enterprises have put into production special machines for pipeline construction that will enable basic line operations to be mechanized and a high rate of construction to be provided for. The level of mechanization of earthmoving work during trunk pipeline construction has reached 99.7 percent, the erection of special constructional structure 99.4 percent, the execution of concreting and of reinforced concreting 92.5 percent, and the construction of pipelines within oil and gas fields 87 percent.

A number of specially produced machines that will greatly speed up pipeline construction in West Siberian regions are current in the production stage. These are a rotary ditching excavator for excavating fully shaped ditches in permafrost soils, and towed platforms based on the air-cushion (VN) principle, which will form the basis for organizing the production of complexes for summer pipeline construction. It is planned to produce a new generation of complexes for the resistance welding of pipe 1,020-1,420 mm in diameter, including complexes that can weld even on curved parts of the line.

Measures taken in 1982 to further integrate mechanization and automation of construction have enabled manual labor to be reduced by an estimated 1 million rubles' worth of construction and installing work in comparison with 1980--a reduction by 7.3 percent for earthmoving operations, 10 percent for loading and unloading work, 12.9 percent for concreting and 7.2 percent for finishing work. In 1985 the reductions will amount, respectively, to 15, 20, 17 and 14 percent.

The industry's integrated science-and-production program for reducing manual labor in construction work and in industrial operations calls for the release in 1981, through the mechanization of construction and installing work, of 2,367 persons who had been engaged in manual labor, of 1,730 persons in 1982, 2,470 in 1983, 1,580 in 1984 and 1,810 in 1985. In all, 9,960 people will be released during the five-year plan.

The unit capacity and load-lifting capability of construction machinery were increased over 1980's: from 0.68 to 0.77 m^3 (average bucket capacity) for single-bucket excavators; from 10.4 to 14.5 tons for bulldozers; from 32.3 to 42.1 tons for pipelayers; and from 22.0 to 27.0 tons for erecting cranes.

The output of construction machinery and the average daily utilization thereof rose 8-12 percent in 1982. This was not a temporary improvement, for the ministry considers it the start of a steady growth in output. The improvement in equipment utilization was reached by the conversion of many organizations to two-shift operation for heavy equipment and a reduction in idle equipment time through reduction of the time spent in redeployment within Glavvostoktruboprovodstroy [Main Administration for Pipeline Construction in the Eastern Economic Region], Glavtnuboprovodstroy [Main Administration for Pipeline Construction], and Glavyuzhtruboprovodstroy [Main Administration for Pipeline Construction in the Southern Economic Region] because of the construction of pipelines within a single corridor. The level of technical maintenance and repair of the equipment has been raised directly within construction organizations and centrally within the newly created VPO Soyuzremonttruboprovodtehnika [All-Union Industrial Association for the Repair and Maintenance of Pipeline Equipment]. The reliability of imported and domestic equipment has also been increased.

Construction organizations are being supplied with machinery for ripping up frozen soil. This will enable the output of the single-bucket excavators and the small machinery that are used by the spreads to be increased during the winter. The construction season has been lengthened by the building of log roads and the use of swamp-traveling vehicles. Construction organizations have been reorganized and restructured (integrated pipeline trusts have been established).

The level of equipment utilization in Glavvostoktruboprovodstroy [Main Administration for Pipeline Construction in Siberia] has risen over that of preceding years: in 1982 excavator output reached 102,500 m^3 , bulldozer output was 31,000 m^3 .

In 1983, with two-shift operation, the branch's output should reach 111,000 m^3 per year per 1 m^3 of bucket capacity for single-bucket excavators and 35,500 m^3 per average assigned bulldozer with a tractive effort of 60 kN.

This will be provided for through wider introduction of the brigade contract and the inclusion of equipment-operator crews in brigades that are working on a single job order, and also through propagation of the achievements and experience of such leading workers as excavator operators Heroes of Socialist Labor A. S. Isayev, N. A. Tyunin and A. Z. Vinyakov, who are yielding a steady output of 235,000-340,000 m³ per 1 m³ of bucket capacity, and of bulldozer operators V. V. Shishakov, I. D. Aleksandrov, A. Yu. Gedzik and P. A. Danil'yuk, who have achieved outputs of 360,000 to 400,000 m³. These indicators confirm the existence of substantial unused reserves on the part of other crews of construction subunits.

Despite the overall growth in the output of the main construction equipment within the industry, some organizations have not met the plan task for this indicator. Glavvostoktruboprovodstroy, Glavtruboprovodstroy, Glavkomigazneftstroy [Main Administration for the Construction of Gas and Oil Industry Enterprises in the Komi ASSR], Soyuzgazpromstroy [All-Union Association of USSR Minneftegazstroy] and Tatneftstroy [Trust for the Construction of Oil Industry Enterprises in the Tatar ASSR] must take steps to improve equipment utilization.

The NOT [Scientific Organization of Work] Center "Neftegazstroy" has studied reserves for increasing labor productivity by the setting of technical norms (a study of hidden internal worktime losses and of the level of manual labor).

Worktime losses within shifts, according to the data of selected observations, was 11.7 percent for the ministry in 1982, versus 12.9 percent in 1981. But for Glavvostoktruboprovodstroy, Glavsibtruboprovodstroy and Turkmenneftegazstroy [Main Administration for the Construction of Oil and Gas Industry Enterprises in the Turkmen SSR], lost worktime within shifts grew, respectively, from 23.3 to 26.9 percent, from 11.7 to 15.6 percent, and from 11.8 to 12.2 percent.

Within-shift worktime losses are caused mainly by a lack of materials (27.6 percent), violation of labor discipline (21.8 percent), a malfunctioning of equipment or a lack of equipment, machinery or tools (16.5 percent), or the lack of a work front (9.7 percent). These data testify that the utilization coefficient of construction machinery can be increased not only by reducing idle time for whole days while the equipment is under repair or awaiting repair but also by reducing losses within shifts.

The ministry has developed and is implementing integrated measures for improving the utilization of and repair support for construction and transport equipment during 1982-1985. These measures reflect the main actions aimed at carrying out the tasks set by the plan for using construction machinery and automotive transport, as well as questions of the preservation and the efficiency of highly productive machines of high unit capacity and of repair support for them, since they should provide for fulfillment of the ministry's programs not only during this five-year period but also during later ones. This is especially urgent today, when the capacity of the ministry's equipment fleet has grown. In the modern era, the equipment fleet has become the main factor in the overall results attained by construction subunits. The

overall effectiveness of construction work depends upon the quality of its use and upon its operating condition.

In other words, the total effectiveness of a construction organization depends, other conditions being equal, upon the characteristics of the repair system and the effectiveness of this system, and this, in turn, is a function of the structural makeup of the construction organization.

The rates and volume of the industry's construction work have required that the industry be equipped with high-powered complicated construction machinery, but the system of repair has lagged greatly in the structural and organizational aspect. The repair base for construction organizations and the structure of subunits engaged in repair must be established ahead of time, since this system has been transformed from an incidental factor into an important causal factor for further increasing construction operating effectiveness, and it has become an area that has substantial internal reserves at its disposal.

The following situation prevailed in the industry in January 1983: of 106 general contracting trusts, 41 were engaged in pipeline construction. Seventy-one percent of the active portion of the capital (in terms of cost of the working machinery) has been concentrated here, including 94 percent of the excavators of increased bucket volume for construction on the line, 78 percent of the bulldozers of 294 kW power, and 91 percent of the pipelayers of 50 or more tons of load-lifting capacity. However, all of the ministry's 53 mechanization administrations are in trusts that are working on site construction, and the equipment of the trusts engaged in construction work on the line do not have specialized subunits for maintenance and repair, except for the partial fulfillment of these functions by SUPNR [Specialized Administration for Startup and Setting-Up Operations] forces since 1980.

Given the new organizational structures for pipeline construction and the concentration of highly productive equipment at and the transfer of such equipment to specialized administrations of pipeline trusts (PMK-1 [Mobile Mechanized Column No 1], PMK No 2 and KTP [Equipment Monitoring Center]), the necessity for establishing mechanization administrations for centralized repair and technical maintenance within such trusts is especially great.

In conformity with the industry's master control scheme which the Minneftegazstroy board has approved, service structures for the maintenance of construction machinery and for the repair support thereof are being established within the industry.

These services are being set up in three stages.

In 1980, for the first time in construction practice, the All-Union Industrial Association for the Repair and Technical Maintenance of Equipment--the VPO Sotyuzremonttruboprovodtekhnika--was established. It comprises 10 specialized administrations for performing 24 million rubles' worth of centralized current repair and technical maintenance of heavy equipment, 5 repair plants with a production program of 32 million rubles' worth of overhaul, 30 replacement centers that replace components and assemblies, with an operating volume of

18 million rubles, and a Spetskomplektimport [Specialized Administration for Supply Support for Imported Equipment] and 4 branches thereof for the centralized supply of spare parts.

Fifteen mechanization administrations for the centralized repair and technical servicing of equipment for pipeline construction are to be created in 1983, and by 1985 their number is to be brought up to 40. Currently, the basic legal papers for creating mechanization administrations and for enumerating the missions of centralized repair, technical servicing and diagnostics have been worked out and approved. This will enable repair-services structures to be established within the industry that will answer the needs of construction organizations more completely.

It is planned to create in 1984-1985 repair plants and centralized workshops for repairing special pipeline-construction equipment and for manufacturing 6-8 million rubles' worth of small powered items at main administrations and associations.

The proposed repair-services system involves the structural shaping of the branch's construction organizations. Structural transformations will enable 80-85 million rubles' worth of centralized technical servicing, repair and diagnostics by 1985 versus the 22 million rubles' worth achieved last year. By 1987 these amounts will reach 120-150 million rubles.

The repair program planned for 1983-1985 will be characterized by the following indicators (1980 indicators are given for comparison):

[Tasks]	Millions of rubles' worth			
	1980	1983	1984	1985
Overhaul (total).....	56.2	84.0	93.8	111.0
Centralized at the industry's plants.....	20.6	32.0	34.8	39.0
Performed in construction organization				
repair shops.....	24.2	40.5	43.0	49.0
Performed under cooperative arrangements...	4.5	7.0	8.0	9.0
Performed by replacing components and				
assemblies.....	--	11.5	16.0	23.0
Centralized technical maintenance (total)....	8.8	50	70	85
Performed by SUPNR forces.....	8.8	24	27	30
Spare-parts manufacture.....	7.2	11.0	12.0	15.0
Restoration of worn parts.....	2.0	4.5	6.0	7.5

It is planned to expand the component and assembly method of repairing machinery in 1983-1985 by increasing the annual program for replacing components and assemblies to 22-24 million rubles, opening up new replacement centers, and organizing branches of the Tyumengazstroymash plant in Nadym and Surgut and parts-restoration sections in Urengoy, Igrim, Nefteyugansk, Novokuybyshevsk, Ufa and Kazan.

It is planned to rebuild and reequip repair plants in Tyumen, Leninogorsk, Bryansk and Chelyabinsk. The number of heavy pipelayers and bulldozers, single-bucket excavators and pipelayers that are based upon Cheboksary plant

tractors and are to be repaired will be increased, and the amount of work done to manufacture and restore spare parts for domestic and imported machines will be greatly increased.

The repair-work base for construction organizations is to be further developed and strengthened. Additional space in the amount of 40,000 m² is to be introduced, and enterprises will be organized within this space to repair special construction equipment for Glavsbiruboprovodstroy, Glavyumentruboprovodstroy, Glavyumentneftegazstroy, Glavvostoktruboprovodstroy and Glavtruboprovodstroy in the amount of 6-8 million rubles' worth of repairs each.

Progressive methods developed by UkrSSR Academy of Sciences institutes for restoring and increasing the durability of machinery parts during repair and manufacture with the application of new deposition-welding technology are to be introduced: flux-cored electrodes, special electrodes, powder-spraying deposition, electroslag remelting, and others.

Technical resources for repair and maintenance work under line conditions also are being introduced: 120 semistationary sectional-type workshops, 680 PRM-type mobile repair workshops, 140 mobile knock-down shelters, 120 quick-repair OM-1 vehicles and 20 mobile diagnostic installations. All mechanization administrations are to be provided with centrifuges for cleaning lubricating oil. Repair enterprises and repair centers will be supplied with metal-cutting tools, forges and presses, and repair-technology equipment in accordance with an analysis and computations that have been performed.

An approved program for training mechanical personnel that pays special attention to the selection and training of maintenance personnel for high-powered equipment is being implemented.

Centralized equipment maintenance by the machinebuilding ministries under the Servis method is being worked out. Questions of replacing components and the variety and quantities thereof are in the coordination stage with Minstroy-dormash [Ministry of Construction of Construction, Municipal and Road Machine Building]. Introduction of this system is planned for 1984.

In the first half of 1984, the provisioning of repair plants and repair shops with repair-technology documentation is to be completed.

Realization of the contemplated program will enable the operating periods of the basic construction machinery to be extended 1½ to 2 years past the standard service life, an operational readiness factor on the 0.82-0.85 level to be provided for construction equipment, and basic construction-machinery performance to be increased 18-20 percent by 1985 to the following indicators: for excavators 120,000 m³, bulldozers 38,000 m³. Average daily utilization of basic machinery will be brought up to 13-13.5 hours per day.

In order to further improve the use of construction and transport equipment in the branch, a science-and-production subprogram, "Raising the Level of Use of Construction Machinery and Transport Equipment and Improving the Branch's Repair Support System," based upon advanced achievements and new domestic and foreign developments, is now being worked out.

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PIPELINE CONSTRUCTION

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SYSTEM FOR CENTRALIZING PIPELINE-BUILDING EQUIPMENT REPAIR DESCRIBED

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 7, Jul 83 pp 5-6

[Article by N. I. Simorov of VPO Soyuzremonttruboprovodtehnika [All-Union Industrial Association for the Repair and Maintenance of Pipeline Equipment]: "Centralized Maintenance of Complicated Construction Equipment"]

[Text] The effectiveness of equipment utilization and the amount spent on equipment operation depend greatly upon the precise organization of technical maintenance. Special attention is being paid to this question, and also to organizational and technical measures for maintaining construction machinery in an efficient state. Planned preventive technical maintenance enables increased part wear to be prevented and machinery breakdowns to be reduced. Planned preventive technical maintenance calls for preshift maintenance (Ye0), which is performed before the start of the workshift, and periodic technical maintenance (T0), which is performed in a planned procedure after a definite number of hours of running time, as established by the manufacturing plant.

In preshift technical maintenance, which, as a rule, is performed by the operator before the workshift starts, checks are made for oil and water leaks and for the attachment of electric wires, fasteners are tightened, components and parts are lubricated at the places recommended by the manufacturer, sediments are removed from fuel filters and tanks, the machine is filled with fuel and lubricants, and the oil pressure in the engine is measured.

Periodic technical maintenance (T0) is performed by the personnel of specialized brigades that are equipped with special tools and devices and a set of spare parts. The types and amounts of work done should correspond to those indicated in the manufacturer's instructions for the operation and maintenance of the specific machine. As experience in the T0 for complicated equipment has indicated, in many ministries and agencies the most effective system for organizing technical maintenance is a centralized one, which enables timely engineering and technical preparation, including: the provisioning of technical maintenance documentation; the supplying of technical maintenance processes with special equipment, devices and tools; the organization of materials and equipment support with the spare parts and materials required for the repair work; the training of workers and improvement of their skills; and monitoring of the quality of the work done in order to meet repair and maintenance documentation requirements.

The organization of Soyuzremonttruboprovodtehnika has enabled a centralized system for the technical maintenance and current repair of equipment and machinery by specialized startup and setting up operations administration (SUPNR's) personnel to be established; repair plants to be specialized in centralized overhaul; and a spare parts supply for SUPNR subunits to be centralized through a Spetskomplektimport [Special Administration for the Supply Support of Imported Equipment] base.

In creating a network of specialized administrations and production sections, the association started out with the job of siting them as closely as possible to the places where the maintenance work assigned them is to be performed. The interrelationships between the SUPNR and the construction administrations--the possessors of the construction equipment associated with centralized maintenance--is governed by specially developed regulations.

The SUPNR does startup, setting-up and adjustment work, technical maintenance and the concomitant repair of complicated domestic and imported construction equipment on the basis of an agreement concluded with the construction administrations or trusts. An integral part of the agreement is an annual schedule for performing maintenance, which is made up on the basis of the plan tasks for machine running time. The annual schedule is broken down into more specific tasks and refined by monthly schedules, which are prepared to take into account the actual running time and the condition of the machines and the T0 or repair work that is to be conducted. The types and periodicity of the technical maintenance performed centrally by SUPNR forces conforms with the manufacturing plant's recommendations.

The Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] system has adopted the following types and periodicity of technical maintenance for heavy imported equipment: T0-1 is performed every 250 motor hours, T0-2 every 500 motor hours and T0-3, T0-4 and T0-5 every 1,000, 2,000 and 3,000 motor hours, respectively.

Technical servicing provides for normal operating capability of the machine during the planned cycle of repairs, provided the operator observes the rules for operation and for performance of preshift maintenance. However, because of the specific soil and climatic conditions under which most of the machines operate when trunk pipelines are being built, cases of premature breakdown of various equipment parts and components do occur. For rapid restoration of the operating capability of equipment that has gone out of commission, specialized SUPNR's do unplanned repairs, which are made not only when machinery fails but also when a tune-up mechanic determines, while performing technical maintenance, that a part or component can, because of its technical condition, become inoperative in a short time. In this case, the SUPNR brigade makes a so-called "spinoff" repair, which, when the machine's overall operating time is considered, will enable the idle time involved in awaiting the SUPNR brigade's arrival, searching for the malfunction, and determining the method for eliminating the breakdown to be reduced.

In planning the work volume for the current year, all types of T0 accomplished by the SUPNR's are counted, the basis for which is the amount of construction

machinery accepted for maintenance under the agreement that has been concluded and the approved schedules for performing the maintenance.

The centralized maintenance system has enabled rational use of the imported spare parts that have been purchased.

With introduction of the centralized maintenance system, it has now become necessary to improve the system for providing spare parts to subunits that are engaged in maintenance and repair. For these purposes, a Spetskomplektimport base has been established under Soyuzremonttruboprovodtehnika in Rasskazovo, Tambov Oblast, with branches in the cities of Lyubno, Moscow Oblast, and Bryansk, Chelyabinsk, Tyumen and Labytnangi. Regular reporting on the traffic in spare parts has enabled purchases thereof to be correctly assessed in regard to both variety and amount. In case of severe need for some kind of a part, the matter of dispatching it from the base or transferring it from one SUPNR to another is resolved responsively. In order to store an optimal amount of spare parts, warehouses have been established under each SUPNR, which supply the warehouses of the SUPNR sections and, when necessary, also the storage facilities of SUPNR brigades that are located directly on the pipeline.

This system of centralized maintenance and repair of complicated domestic and imported construction equipment still has not reached its perfection. Organizational and technical questions that will enable effective use of all the advantages that centralization of T0 operations and repair yields have not been resolved, and the SUPNR production bases are slow in being developed.

The lack of a technology design base within the association does not allow SUPNR subunits to be supplied with the necessary papers for the technical maintenance and repair of machinery.

The requirement for the responsive shipment of spare parts to the places where the machines operate and the rising amount of haulage of spare parts from the Spetskomplektimport base to SUPNR storage require that an automotive transport unit, which would be able to take on the centralized delivery of spare parts and other transport work, be created under the association.

Improvement of the centralized technical maintenance system will enable the effectiveness and quality of the work that the SUPNR performs in maintaining construction machinery in operating condition, in responsively solving the problems of restoring it, in reducing unplanned idle time, and in maintaining a constant operational readiness factor no lower than 0.85-0.9 for the construction-equipment fleet, to be provided for.

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PIPELINE CONSTRUCTION

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MOBILE UNITS FOR REPAIRING PIPELINE-BUILDING EQUIPMENT ON SITE DESCRIBED

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 7, Jul 83 pp 6-7

[Article by Yu. S. Vorontsov of the Bryansk Branch of the Gazstroymashina SKB [Special Design Bureau]: "Resources for Technical Maintenance"]

[Text] Technical maintenance and current repair of machinery that takes part in trunk pipeline construction are complicated by the fact that these operations must be carried out where the equipment operates, primarily where temperatures are low, there are no roads, the machinery is widely scattered along the right-of-way, and distances thereto from fixed repair bases and housing are great. In creating resources for maintaining machinery on the line, specialists of the Bryansk Branch of the Gazstroymashina SKB give consideration to such requirements as mobility, high off-the-road capability, the potential for safe haulage of the repair brigades, the existence of heated premises for rest and for warm-up break for personnel, and independence in supplying power and load-lifting capability.

Some items of this equipment are produced serially by Remmekhgazprom [Trust for the Repair of Gas Industry Machinery] and Soyuzremonttruboprovodtehnika [All-Union Industrial Association for the Repair and Maintenance of Pipeline Equipment] plants.

The AM1 workshop, based on the Ural-385Ye truck and manufactured by the Bryansk Plant for Diesel-Machinery Repair, has been created. It is intended for performing current repair on construction machinery in the pipeline environment by the assembly and component method. Special open metal bodies serve for hauling spare parts, as well as defective component parts that have been removed from the machinery, which weigh less than 4 tons. The presence of a hydraulic gantry loader enables individual loading into and offloading from the vehicle's body of units that are being hauled and loading and unloading operations to be performed during disassembly and assembly, when defective units are being replaced. A set of gas-welding equipment, installing tools and tying equipment are placed in a special compartment of the body behind the cab. The workshop when loaded weighs 9,300 tons [as published].

Serially produced PRM5A, PRM7 and PRM8 mobile repair shops, which are based on the ZIL-131 (or ZIL-157) truck and the Ural-375Ye truck, and are intended

for the integrated technical maintenance of construction machinery on the pipeline, are being produced serially by Rasskazov's Spetsstroymashremont plant. A 1-kV·A three-phase gasoline-electric unit, work benches and a table-mounted drill, an electrical sharpener and vises, installing tools, and gas-welding equipment are placed in the unified, heated metal bodies of the repair shops. A removable jib for manual hoisting with a load-lifting capability of up to 1 ton helps in loading and unloading. Soft benches with safety frames and two hammocks for resting at night have been supplied for hauling brigades in the vehicle body.

The Lvov Machinery Plant is producing the PURM1 mobile section-level repair shop, which is intended for the technical maintenance and repair of construction machinery that has been concentrated at one location. The shop's equipment is placed in two V0-10 type mobile huts and on a 2-P5.5 automotive trailer. The huts, when being deployed, are set up on special bogies. In the working position, the huts are placed on temporary supports, using off-the-shelf skids. In the covered truck-trailer there are a DESM-30 diesel-electric generator set, a GP 0.15/10 air compressor model II36-82, a TSKB-1112 jet washing installation, a 390M lubricant-grease heater, and a traveling gantry crane.

A 1D95 general-purpose combination lathe, mechanics' work benches, shelves for storing spare parts and materials, an electric vulcanizing apparatus, a stand for repairing and testing electrical instruments, and equipment for gas and electric-arc welding are placed in the huts, each of which is 30 m² in area. The shop's total weight is 25 tons.

The PRT1 knock-down shelter, which is produced serially by the Lvov Machinery Plant, is intended for sheltering repair personnel and the machines being serviced from atmospheric precipitation. The shelter can be installed directly at the operating site of the machine to be repaired or at the place where it was forced to stop. The shelter consists of a knock-down tubular framework and replaceable panels made from fabric resistant to moisture and cold. No load-lifting mechanisms are required for erecting it. The area of the erected tent is 12x5.4 m, and its height of 4.8 meters along the ridge pole enables practically any machine to be sheltered. Thanks to the telescoping design of the framework's pole, which is adjustable in height, the area where the shelter is to be set up need not be leveled. In the transporting position, the shelter and the repair-operations equipment are placed in a covered MAZ-8926 automotive trailer. A DESM-30 diesel-electric generator, an SM2 steam-jet cleaner, a heating tank and water, and an electrical heater are installed on the trailer. Hot air supplied by the electrical heater can be sent to the place where the repair and adjusting work is being performed by means of a fabric sleeve that is as much as 4 meters long. The workplaces are lighted by drop and portable low-voltage luminaires.

An OM1 emergency-response vehicle, which is based on the UAZ-452 van and is produced by the Ukhtagazstroy plant, is intended for the rapid delivery of repair brigades to the place where emergency work is to be done in the pipeline environment and for the simultaneous haulage of not more than 150 kg of the required spare parts.

The vehicle has benches for hauling 5-6 members of a repair brigade, and it is supplied with portable vises and a set of mechanics' tools and diagnostic instruments.

A test model of a PRK1 mobile repair complex has been fabricated by the Lvov Machinery Plant. It will find application as a mobile repair base that performs technical maintenance and current repair on domestic and imported construction machinery and powered devices that are included in an integrated operating column or an integrated spread that erects trunk pipelines.

The complex consists of two V0-10 type cars, each of which is installed on a sled frame and is equipped with a folding roof and swinging door flaps, which enable the creation of about 74 m² of additional operating space which is protected from the effects of rain, snow and wind. A 100-kW ASD-100 electrical unit, a 1D95 general-purpose combination lathe, mechanics' work benches, shelves for storing spare parts and materials, electrical vulcanizing equipment, a GP-0.15/10 C-412 compressor, a 390M model lubricant-grease heater, gas and electrical welding equipment, an oil-cleaning facility, instruments for monitoring fuel and electrical equipment, and a 2163-M2 hydraulic press have been placed in the cars, which are each 30 m² in area.

A living compartment for the repair brigade's relaxation has been placed in one car. The cars are heated by electrical heaters. Hot air is fed into the production compartment, which is situated between the cars, from the electrical heaters. Total weight of the complex is 33,000 kg.

The Bryansk Branch of the Gazstroymashina SKB is now developing working designs for mobile repair shops that are based upon KrAZ-255B and KamAZ 4310 trucks, which have great off-the-road capability and a wider operating potential for maintaining and repairing equipment.

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PIPELINE CONSTRUCTION

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MAINTENANCE OF HYDRAULIC-DRIVE PIPELINE-BUILDING EQUIPMENT DISCUSSED

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 7, Jul 83 pp 7-8

[Article by S. I. Kirillov of Glavneftegazstroymekhanizatsiya [Main Administration for Mechanization of Construction of Oil and Gas Industry Enterprises]: "Organization of a System for Repairing and Maintaining Construction Machinery"]

[Text] The large concentration of expensive equipment imposes on construction organizations great responsibility for providing for the organization of construction work, more productive use and better technical maintenance of construction equipment, and improvement in preserving it.

Construction organizations still are not working single-mindedly for the maintenance of machinery and equipment at an adequately high technical level. Not everywhere yet are the requirements of "Recommendations on the Organization of Technical Maintenance and Repair of Construction Machinery," which was developed by USSR Gosstroy, and of "Regulations on Organizing the Technical Maintenance and Repair of Construction Equipment for Building Pipelines," which was approved by Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] being observed.

Delayed performance of the work required by the regulations and recommended by the manufacturing plants or companies leads to premature wear of components and assemblies and to breakdown of the equipment, and it engenders in some cases an irresponsible attitude by servicing personnel toward its technical status and preservation. The technical maintenance of the industry's expensive machines is being performed by startup and setting-up administrations of Soyuzremonttruboprovodtehnika [All-Union Industrial Association for the Maintenance and Repair of Pipeline Machinery]. In 1982 they performed 13,763 maintenance operations on imported machines (an average of 3.06 per machine from the pool of machinery and equipment accepted for maintenance). During the first quarter of 1983, 6,951 maintenance operations were performed.

Servicing of imported heavy equipment in accordance with the manufacturing firm's recommendations has enabled utilization of the existing equipment fleet to be raised to a new technical level and the overall sophistication of construction-equipment operation and repair to be improved.

In accordance with a master scheme for managing the industry and for organizing the accelerated flow-line construction of gas pipelines by pipeline construction trusts that Minneftegazstroy's board approved, integrated spreads have been created with subunits for road-transport operations and for engineering preparations on the right-of-way. The whole complex of construction equipment (up to 120-140 units) engaged in pipeline construction has been transferred to the books of these spreads. For purposes of centralized maintenance and repair of equipment for pipeline trusts, mechanized administrations are being created that will devote special attention to problems of restoring and rejuvenating worn parts at in-house repair bases, and also of current repair. The centralized restoration of worn parts was organized in 1982 by Soyuzremonttruboprovodtehnika plants. In 1982 more than 350 types of parts worth 2.7 million rubles were restored by various methods of deposition welding. During this same period, construction organizations did only about 2.0 million rubles' worth of such work. Discarded undercarriage parts of tractors, excavators and other equipment were not restored in the full amount. Work to restore worn parts is being introduced poorly in Turkmenneftegazstroy [Association for the Construction of Oil and Gas Industry Enterprises in the Turkmen SSR] and Glavtruboprovodstroy [Main Administration for Pipeline Construction].

In 1983 the amount of work done to restore construction machinery parts should rise to 7.4 million rubles' worth, as much as 4.5 million rubles' worth of it at repair plants. In order to further develop spare-parts restoration at repair plants and in large repair shops of main production administrations and associations, sections for the centralized restoration of machinery parts will be established, which will apply progressive methods for building up worn parts that were developed by the UkrSSR Academy of Sciences.

Hydraulically driven operating implements are being used widely in construction and road machinery. Today 85-90 percent of the basic construction machines in the branch operate on hydraulic drive, which allows greater power, reliability and productivity and, therefore, better working conditions for operating personnel. The increasing complexity of the machines, especially of the hydraulic equipment, has made high demands on organization of the technical maintenance of such machines. The main parts of hydraulic equipment are manufactured with a high degree of precision. Timely conduct of maintenance, the use only of those hydraulic fluids that are recommended by the manufacturers, and adherence to the deadlines and the rules for replacing them will enable their service life to be lengthened and the reliability and longevity of the equipment as a whole to be raised.

In order to raise the quality of technical maintenance of machines with hydraulic drive, technical diagnostics should be done by means of measuring and monitoring instruments. This will enable timely observation of defects of any kind in the hydraulic apparatus, impermissible pollution levels, degradation of the hydraulic fluid's physical or chemical properties, and adequately precise determination of the remaining service life of the various assemblies of the hydraulic drive.

A set of manometers with adapters and connector tubing, tachometers, flow meters, timing devices, thermometers and other instruments are used for technical diagnostics. These devices make it possible to measure pressure at the

check points at the prescribed engine rpm, the productivity and efficiency of pumps, the amounts of leakage in matings and seals, and the discharge pressure of safety and relief valves.

Methods for diagnosing and eliminating malfunctions in the hydraulic systems of construction machinery are described in detail in recommendations developed by the Bryansk Branch of the Gazstroymashina SKB [Special Design Bureau].

In accordance with an integrated program for improving the utilization of and the repair support for construction equipment during 1983-1985, each main administration and association has been given the task of creating within trusts sections for diagnosing machines with hydraulic drive and laboratories for analyzing and cleaning hydraulic operating fluids. Motorized laboratories for construction-machinery maintenance are being manufactured. For example, workers of the services of the chief mechanical engineer of Glavkomigazneftstroy [Main Administration for the Construction of Gas and Oil Enterprises in the Komi ASSR] designed, built, supplied with operating equipment, and turned over for operation in a short time a department for repairing components and for manufacturing various parts of the hydraulic apparatus of EO-4121 excavators. Work is being done to create a shut-off device for use when the seal of a hydraulic system is lost unexpectedly. Tyumengazmekhanizatsiya [Tyumen Trust for the Mechanization of Gas Industry Enterprises] of Glavtyumenneftegazstroy [Main Administration for the Construction of Oil and Gas Industry Enterprises in Tyumen Oblast], jointly with the Tyumen Branch of the Gazstroymashina SKB, has designed and manufactured a motorized laboratory, based upon the Ural-375 truck, for diagnostics of the hydraulic-drive operation of construction machines and for cleaning hydraulic fluids in the pipeline environment.

The initiatives of advanced enterprises should find support in the ministry's construction subunits and should help to raise the operating level of construction machinery with hydraulic drive.

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PIPELINE CONSTRUCTION

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BOOK ABOUT OFFSHORE PIPELINE CONSTRUCTION REVIEWED

Moscow STROITEL'STVO TRUBOPROVODOV in Russian No 7, Jul 83 pp 29-30

[Review by A. A. Shmidt of the book, "Stroitel'stvo morskikh truboprovodov" [Offshore Pipeline Construction] by K. Ya. Kapustin and M. A. Kamyshev, Izdatel'stvo "Nedra"]

[Text] The development of methods for laying offshore pipelines.

Izdatel'stvo "Nedra" has published the book, "Offshore Pipeline Construction," by K. Ya. Kapustin and M. A. Kamyshev.

The development of offshore oil and gas fields, which is being expanded, requires the development of hydraulic-engineering construction and the use of effective methods for laying pipelines under water. Offshore pipelines are complicated engineering structures. They cannot be designed and built successfully without basic research.

The book presents the results of theoretical and experimental research performed by VNIIST [All-Union Scientific-Research Institute for Trunk Pipeline Construction], and it is aimed at solving problems associated with erecting offshore pipelines. A complex of problems is examined--the requirements for design, the improvement of constructional structure and pipelaying equipment, the provisioning of stability, methods for testing and operation, and protection of the environment.

The book examines factors that must be considered when designing offshore pipelines. These include the environmental parameters (the influence of currents and wave action, seismic, geological and engineering-geology conditions, water temperature, the degree of water pollution and corrosiveness, and so on). An important factor that guarantees correct design, erection and operation is the conduct of detailed engineering surveys in the area of the future construction. The make-up of geological surveys and topographic operations and the data obtained by meteorological and oceanographic research are presented.

Reliability is the chief indicator for offshore pipeline systems. This indicator is the determining factor in choosing the designs for pipelines and the methods for laying them. The data cited in the book that touches on the requirements laid on the pipe and the specifications therefor are important.

Test data on corrosion-fatigue life, which is of paramount importance in selecting an optimal structure for offshore pipelines, are of interest. The tests permit determination of the most rational technology for welding the pipe, which operates in an environment of cyclic loadings. Welding is the leading operation which determines the time required for building offshore pipelines and the strength and permanency of seal of the pipelines. The recommendations on welding technology, conditions and materials that are cited in the book indisputably will be useful to the developers of plans for laying offshore trunk pipelines.

Providing protection from corrosion is a task of special importance for the builders of underwater pipelines. Pipe that is laid along the bottom of the sea should have anticorrosion protection that is designed for the full service life of the pipeline--20-30 years or more.

A chapter devoted to this topic gives a detailed analysis of domestic and foreign experience in preventing the corrosive destruction of metal structure. The most effective measures are recommended. Standard procedures for analyzing offshore pipeline ballasting will be useful for practical purposes. The SNIIP [Construction Norms and Regulations] II-45-75 norms now being applied are unsuitable for computing the loads on pipes that have been laid in sea areas. They meet the prerequisites for the construction only of river crossings. A proposed methodology examines the stability of the whole structure (including the ballast), not of the pipeline and ballast separately, which SNIIP II-45-75 does.

A pipeline that is located on the sea bottom is subject to the effects of wave pressure, which strives to shift and lift it. A correct assessment of the interaction of sea waves and currents with a pipeline that lies on the bottom enables successful operation of it during storms. The book cites a calculation of pipeline stability where the interaction of waves and currents occurs in shallow and deep areas of the sea.

During the last 10-15 years, effective methods for laying pipelines offshore from pipelaying ships, on which sections of pipe completely ready for laying have been mounted, are used in domestic and foreign practice. A chapter dedicated to methods for laying offshore pipelines cites an analysis of various methods for laying that are employed in our country and abroad. Special problems in laying from an inclined ramp on a pipelaying ship or from a drilling ship, methods for dragging the pipe along the bottom, and the method of free submergence are examined. Specifications for pipelaying ships are given here. The development and improvement of their design and parameters are interesting.

In the 1970's powerful ships, flat-bottomed barges 195 meters long, pipelaying ships of 25,000 tons displacement and pipelaying ships of the semisubmersible type appeared. The semisubmerged "Viking Payper," with a displacement of 50,000 tons and the self-propelled YeTRM-1600 pipelaying ship of 60,000 tons displacement will enable pipelines to be laid in practically any part of the sea at depths of up to 360 meters.

The book throws light on problems that until now have been studied but little. For example, the construction of pipelines under icy conditions. A laying method developed by VNIIST that uses an ice stinger and a method for element-by-element assembly of pipeline on a pipelaying platform suitable for operation under icy conditions were examined, and a Canadian-developed pipe-layer for laying from ice is described.

An analysis of methods for underwater welding is of practical interest. A method for semiautomatic welding with a flux-cored electrode that was developed by the Institute for Electrical Welding imeni Ye. O. Paton is effective. The principles and technology for such welding are described. It is indicated that its use will produce high-quality joints.

There are at present no All-Union construction norms and regulations that regulate the design and erection of offshore pipelines. VNIIST has developed special recommendations (R412-81) on these questions. These were drawn up on the basis of SNiP II-45-75, existing domestic experience, and foreign standardizing documents. The book cites norm-setting for calculations, the static calculation for laying, calculations for strength that take ship oscillations into consideration, the determination of forces during towing, and so on.

One of the important operations is the burial of pipelines in the seabed. It is done with a view to protecting the pipe from mechanical injury by ships' anchors and trawls and also from soil being washed out from under the pipeline by waves and current action. In a chapter dedicated to matters of excavating underwater trenches, the characteristics of the soils, a classification of methods for building the trenches, and the equipment used are given. Pipe-burying devices that reduce the amount of underwater earthmoving work and the cost and time involved are described.

Protection of the environment is a most urgent problem when erecting offshore pipelines. Even unsubstantial pollution of the sea leads to irreversible processes and to the destruction of flora and fauna, not only in water bodies but also on land nearby. Pollution of the sea with crude oil now comprises about 10 percent of all such pollution.

Undoubtedly, the measures for preventing environmental pollution that are cited and systematized in the book, and also the list of the causes of the negative effect of it, are important.

The most effective way of protection is further improvement of the design and technology for laying offshore pipelines. The developments cited in this book, as well as the conclusions drawn by the authors on the basis of a systematic study and an analysis of available experience, undoubtedly will help in the fulfillment of this task. The book is intended for engineers and technicians of the oil, gas and shipbuilding industries.

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PIPELINE CONSTRUCTION

PROGRESS ON URENGOY-UZHGOROD GAS PIPELINE CONSTRUCTION IN MAY 1983 TOLD

Moscow EKONOMICHESKAYA GAZETA in Russian No 24, Jun 83 p 3

[Article by V. Voznyak: "On the Right-of-Way in May"]

[Text] Construction of the linear portion of the Urengoy-Pomary-Uzhgorod gas pipeline has entered its concluding phase.

At the start of June, for the construction project as a whole, out of a total length of 4,451 km, 4,400 km had been welded into the strand and 4,330 km had been insulated and laid in the ditch.

Many construction workers' collectives have completed erection of their portions. In May the main volume of welding, insulating and earthmoving work on the gas pipeline was performed by trusts of Glavtruboprovodstroy [Main Administration for Pipeline Construction], Glavyuzhtruboprovodstroy [Main Administration for Pipeline Construction in the Southern Economic Region] and Glavukrneftegazstroy [Main Administration for the Construction of Oil and Gas Industry Enterprises in the Ukraine] on the land of Orel, Kursk, Sumy, Poltava, Cherkassy and Vinnitsa Oblasts. GDR builders made great headway in erecting gas pipeline in Ternopol and Ivano-Frankovsk Oblasts.

Zaktruboprovodstroy [Caucasus Pipeline Construction Trust] of Soyuzintergazstroy [All-Union Association for the Construction of International Gas Pipelines], which is laying the trunk line through the Carpathian mountains, worked strenuously in May. Collectives of integrated flow-line operations groups of Rostovtruboprovodstroy [Rostov Pipeline Construction Trust] and Krasnodartruboprovodstroy [Krasnodar Pipeline Construction Trust] distinguished themselves in their work. Collectives of Glavtruboprovodstroy did much work in Tyumen Oblast in May on the fitting of the connecting components that join the compressor stations to the gas pipeline.

A complex of operations associated with testing individual portions of the gas pipeline under pressure was accomplished in May at an accelerated pace. During the month 700 km were tested--a bit less than in all the preceding time.

Soyuzpodvodtruboprovodstroy [All-Union Association for the Construction of Underwater Pipelines] did much work on erecting complicated underwater river

crossings of the trunk pipeline. In May an inverted siphon was laid across the Zbruch River in Ternopol Oblast, and work on erecting a crossing of the Uday River in Poltava Oblast was completed. Thus, in June all water obstacles will have been crossed.

The main attention now must be paid to the construction of compressor stations. To a great extent their successful erection will depend upon precision in the delivery of operating, electrical-engineering and other types of equipment. Minkhimmash [Ministry of Chemical and Petroleum Machine Building] enterprises dispatched their output, primarily new types of gas-transfer pumping units with aviation drive, on time or ahead of time. The delivery of equipment to Mingazprom [Ministry of Gas Industry] enterprises has been strengthened. At some compressor stations, USSR Minmontazhspetsstroy [Ministry of Installation and Special Construction Work] subunits have already started installing operations.

Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] stations (the Pravopekhotnaya, Verkhnekazymskaya and Oktyabr'skaya in Tyumen Oblast and the Pomarskaya in the Mariyskaya ASSR), the Mintyazhstroy [Ministry of Construction of Heavy Industry Enterprises] station (Ivdel'skaya in Sverdlovsk Oblast), the USSR Minstroy [Ministry of Construction] station (the Algasovskaya in Tambov Oblast), and the USSR Minenergo [Ministry of Power and Electrification] station (the Chaykovskaya in Perm Oblast) are being built at a rate that outpaces the schedules. The Barskaya Compressor Station in Vinnitsa Oblast is being erected successfully by GDR construction workers.

It is required that the compressor stations be put into operation in unison with the necessary approach roads, housing, cultural and domestic-amenity facilities, and water-supply and sewer systems, with the appropriate treatment structures. The construction of these facilities has started at many stations, but they are given less attention than the erection of production capacity.

Youth continue to arrive by Komsomol work ticket for the construction of the gas pipeline. All the necessary production, housing and living conditions for highly productive labor must be created for the young workers, and, if necessary, their training as construction specialists must be organized.

Student construction detachments will arrive on the line this summer. Consequently, it is necessary right now to prepare well for their arrival: to ensure the necessary reserve of building materials at the facilities, and to think out the organization of work and recreation.

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PIPELINE CONSTRUCTION

PROGRESS ON URENGOY-UZHGOROD GAS PIPELINE CONSTRUCTION IN JUNE 1983 TOLD

Moscow EKONOMICHESKAYA GAZETA in Russian No 29, Jul 83 p 3

[Article by A. Panin: "In June on the Right-of-Way"]

[Text] A terminal section of the Urengoy-Pomary-Uzhgorod gas pipeline, which is 1,043 km long, has begun to operate.

Erection of the linear portion of pipeline on the Urengoy-Pomary-Uzhgorod line is approaching its end. As of 1 July this year, out of 4,451 km, 4,440 km had been welded into the strand and 4,431 km of pipe had been insulated and laid. Startup and setting-up work and the construction of compressor stations and other facilities are being promoted along the whole route now.

These data testify to the gigantic amounts of work carried out in practically 1 year of work alone (construction organizations of Minneftegazstroy [Ministry of Construction of Petroleum and Gas Industry Enterprises] started to build the gas pipeline in May 1982).

Two million seven hundred thousand tons of pipe were delivered to the gas pipeline's right-of-way, 2.1 million running meters of joints were welded and about 25 million m² of pipe surface were insulated. Soil in the amount of 128 million m³ was shifted, including 4 million m³ of rock. Twenty seven million square meters of fertile land were recultivated. About 800 crossings of water obstacles were built, including 21 large two-strand crossings over such rivers as the Nadym, Ob, Chusovaya, Kama, Volga, Don and Dnepr.

About 400,000 ballasting weights, which weighed almost 2 million tons, were manufactured at construction-industry plants, delivered to the right-of-way and installed, about 29,000 tons of valve fittings were installed, and more than 1,300 km of electric-power line were erected.

Collectives of 50 integrated flow-line operating groups did the construction work. The maximum worker manning on the right-of-way during the most strenuous period was 10,000.

During the concluding stage of construction of the gas pipeline's linear part, socialist competition is being promoted widely among the collectives of Minneftegazstroy organizations, which responded enthusiastically and in business-like fashion to the decisions of the June 1983 CPSU Central Committee Plenum. Among the collectives that attained high indicators with their labor, the

flow-line groups of Ukrtruboprovodstroy [Ukrainian Pipeline Construction Trust] (the chief is V. Beloborodov) and Rostovtruboprovodstroy [Rostov Pipeline Construction Trust] (the chief is E. Nemchinskiy) should be singled out primarily.

Subunits of the welding and installing trusts Severotruboprovodstroy [Trust for Pipeline Construction in the Northern Economic Region], Tatnefteprovodstroy [Tatarskaya ASSR Pipeline Construction Trust] and Komsomol'sktruboprovodstroy [Komsomol'sk Pipeline Construction Trust] made a great labor contribution to erection of the gas pipeline. Collectives of Glavtruboprovodstroy [Main Administration for Pipeline Construction], Glavvostoktruboprovodstroy [Main Administration for Pipeline Construction in the Eastern Economic Region] and Glavsibtruboprovodstroy [Main Administration for Pipeline Construction in Siberia] did strenuous work to complete construction and to test the gas pipeline.

Strenuous work is now under way for the erection of 17 first-priority compressor stations. From 500 to 800 builders are at work at each of them right now. Construction organizations of Tatneftstroy [Tatarskaya ASSR Association for the Construction of Oil Industry Enterprises] and Kazymgazpromstroy [Kazym Trust for the Construction of Gas Industry Enterprises] are setting an example at these facilities. Work to create housing for compressor-station operating personnel has been intensified. Workers of Severogazstroy [Trust for the Construction of Gas Industry Enterprises in the Northern Economic Region] and Nadymgazpromstroy [Nadym Trust for the Construction of Gas Industry Enterprises] achieved good results in this area.

All construction processes on the right-of-way have been carried out by the mechanized method with the use of modern highly productive equipment and progressive technology. About 1,000 heavy pipelayers, 1,700 earthmoving units and 200 welding units were concentrated on the Urengoy-Pomary-Uzhgorod right-of-way.

All this has enabled construction of the linear portion of the transcontinental gas pipeline to be completed in 12 months, whereas the normal time would have been 36 months.

And so an important step in the erection of a unique arterial, a large segment of which has already been connected to the country's Unified Gas-Supply System, is nearing its end. But before the line is fully complete, there is still much to be done, primarily on the construction of compressor stations and the electric-power line, and the erection of settlements along the right-of-way for operating personnel will be promoted widely.

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PIPELINE CONSTRUCTION

PROGRESS IN ERECTION OF UKRAINIAN PART OF URENGOY-UZHGOROD PIPELINE TOLD

Kiev PRAVDA UKRAINY in Russian 8 Jun 83 p 3

[Article by Ya. Zhukovskiy: "The Construction Project's Pulse"]

[Text] Ready segments of the Urengoy-Uzhgorod gas pipeline are undergoing tests throughout its whole length. Several stretches of the arterial in the Ukraine are undergoing this test for strength. Water from the Ros, which filled up the first readied section, was pumped to Kiev Oblast, and now it is being repumped to the next section, which is 63 km long. The pressure in the arterial, which had been raised--with a reserve of 10 percent above the designed strength, indicated the readiness of this whole 115-km stretch for the reception of gas.

After Kiev Oblast, tests began at Vinnitsa and Khmelnitskiy, and the pipelines that had been laid in Poltava Oblast were filled with water. Five construction organizations, including Ukrzapadneftegazstroy [Trust for the Construction of Oil and Gas Industry Enterprises in the Western Ukraine] and Ukrtruboprovodstroy [Ukrainian Pipeline Construction Trust], are now verifying the reliability of the readied sections.

In May the main volume of construction work on the right-of-way is being moved increasingly to the republic's western oblasts. Sixty more kilometers of overhead welding are to be performed. That is why subunits that previously had completed work in the central oblasts moved to aid their comrades. Thus, collectives of Ukrainian trusts will now help to weld, insulate and lay the arterial in Ternopol Oblast. More than 20 km of overhead welding have been done in addition. In particular, two Styk welding installations, which had already done a large amount of work in Kiev and Vinnitsa Oblasts, and then also in Khmelnitskiy Oblast, are working there. The installations, which were created by scientists of the Institute of Electrical Welding imeni Ye. O. Paton and by designers of the Kiev Branch of Gazstroymashina's SKB [Special Design Bureau], have replaced the work of a whole construction administration on the right-of-way.

Sixteen integrated flow-line operations groups are operating in the Ukraine. Their work in May was marked by a high stage of organization. During the month they welded overhead joints in more than 110 km of pipe directly on the line, and they insulated and laid 173 km in the ditch. Interruptions at

various places--at roads and railroads, and water obstacles--were quickly eliminated, and the readied sections were extended for tens of kilometers.

In readying the arterial for the reception of gas, the builders are also boosting operations on the erection of compressor stations. This year two compressor stations primarily are needed--at Grebenka in Poltava Oblast and in Bar, Vinnitsa Oblast--to pump Siberian gas. Coolers and other operating equipment are being erected here, and the pipeline feeds to them are being started. The plumbing lines are 80 percent ready. Ninety percent of the metal structure for the gas-turbine electric-power station has been erected at Grebenka, and it has been completely erected at Bar. At both sites, the operators' building and warehouses have been built, and apartment houses have been readied for personnel--two 90-unit apartment houses at Grebenka and a settlement for 400 persons at Bar.

The builders of the compressor stations, which are due for early startup, have asked the collective of the Neva plant in Leningrad to speed up delivery of the main units for pumping gas. When the USA's administration decided to prevent laying of the gas pipeline, linear operations on the right-of-way surpassed the schedule originally made up, and the socialist commitments adopted by the builders were overfulfilled. That is why the builders are following with such attention the news from Leningrad. "We hope," they write, "that the Workers' Relay, under which we operate as the builders and you as the production workers, will bear beneficial fruit."

Construction operations are also going on full blast at other compressor stations, the deadline for introduction of which is 1984.

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PIPELINE CONSTRUCTION

SECTIONS OF URENGOY-UZHGOROD GAS PIPELINE BEING TESTED

Moscow IZVESTIYA in Russian 13 Apr 83 p 1

[Article by B. L'vov and G. Panushkin: "The Gas Pipeline Tests Its Power"]

[Text] Finished sections of the Urengoy-Pomary-Uzhgorod trunk line are being tested.

An unaccustomed silence has come to the gas pipeline right-of-way, which passes through Gorkiy Oblast's Transvolga region. However, this silence is deceptive. The tension that exists today, when practically only one consolidated engineering brigade is left on-site, was not felt during even the most feverish days of the concluding work on the right-of-way here.

"It is true," confirms A. Buyankin, chief of the flow-line operating group of Mosgazprovodstroy [Moscow Gas-Pipeline Construction Trust]. "People are anxious. Hydraulic tests have started. An examination of everything done over a distance of more than 100 km, these are extremely strict and make no allowances."

The spring sun shines warmly. The mobile field hut that has taken root on the P'yana River shore seems especially conspicuous. Inside it is a singular machine room for the tests. Powerful hydraulic units that fill and compress glitter with nickel and copper. The monitoring instruments are observed closely. A diversion pipeline runs from the hut to the shore. It is time to start. The motor began to chug, and water rushed toward the gas pipeline. About 2 m³ of water for each running meter. And there are tens of thousands of such meters. But time does not wait. A short time has been allowed for the tests.

The hours and minutes pass with agonizing slowness. The motor hums smoothly, and one recalls involuntarily a recent time, when the arterial was being born. At that time, after the thaw and wet snowfalls, the work on insulating the pipeline unexpectedly intensified and went on friskily. The welders made haste.

Comradely solidarity sharpened judgment and stimulated an outpouring of energy, and that which had just recently seemed unattainable now appeared feasible and realistic. At critical moments, rich experience on the line

suggested what to do and what to use: during boosted work, when the metal at the electrode was melted more quickly, and during special signaling for rapid change of polarity of the current, and even the skill that is as stable and fixed as a reflex took advantage of the heat left in the joint that had just been made for use in welding the next one.

Indeed, they coped. And now the examination is going on: how did they do? Even the most captious monitoring at times is not able to observe defects. But now the trunk line is filled with water, and the pressuring unit was operating, pumping in "atmospheres." The manometer needle quivered, going increasingly to the right, to the target mark of 82.5 atmospheres--this is the final pressure for the hydraulic tests. The examination for the "red diploma" is in progress. And with each day, as tests are completed, the number of these diplomas awarded--in the Volga and Urals areas and in Tyumen Oblast--increases.

Information about the conclusion of testing of the first section were received with great satisfaction by the builders of the transcontinental arterial in the collective of A. Skokov's flow-line operations group from Omsknefteprovodstroy [Omsk Oil-Pipeline Construction Trust]. The Omskers' success was not easily achieved. The Pelymsk swamps, which are difficult of passage, were crossed in November of last year. But the winter, which was expected to facilitate and speed up this work, which is not easy in any case, with cold weather that ordinarily ferocious at this time, was in no hurry to exert its rights. Even during December, damp weather persisted on the line. The swamps were overflowing, were transformed into lakes, from the rains and mists. Numerous brooks and creeks babbled here, as if it were springtime. Perhaps they could become icebound if it were only a few degrees colder?

The people cannot wait. Of course one cannot expect favors from nature. They came to its assistance. Special tractors set out from the base settlement at Lesnaya Volchanka. With their wide tracks they trampled down the peat, squeezing out the water. At night it froze, and the machinery again went over this route, until ice roads would be formed that would be able to sustain heavy construction equipment--excavators, bulldozers and pipelayers.

They entered the peat bogs that way. But at A. Skokov's 90-km segment, what is more, eight fairly large rivers intersected the right-of-way, including such ones as the Kamenka, Kakva and Lobva, with marshy floodplains throughout. To this should be added also a multitude of such streams, which are not easy to cross. Just try to go there with a swamp tractor! Any one of them would fall into the mud deeper than the cab. "Lezhnevkiye"--temporary log roads--rescued them. They were made from logs up to 12 meters wide, on top of that a second, and then a third. Heavy equipment also traveled along this wooden "layered pie." Ditches were dug from these floating bridges, pipe was welded on them, and insulating and other line work was performed there. The Omskers did their segment in mere weeks.

And so now, while the bright April sun splashes playfully on the freshet floods, the tests confirmed that the heroic work had not been done in vain. The same also could be said about the collectives of the flow-line operating groups of A. Tsai from Komsomol'sktruboprovodstroy [Komsomol'sk Pipeline Construction Trust] and of Ve. Belyayev from the welding and assembly trust.

This is how an important stage in the construction project's biography--the hydraulic checking of finished sections of the arterial--began. Today the pipe has been filled with water over a distance of thousands of kilometers. This is almost a fourth of the arterial. In considering that, as a whole, more than 4,000 km on the line have been welded into the strand and almost as much has been insulated, it is easy to see that the front for the testing operations will later increase continuously. And because of this, completion of it in the full amount will depend greatly upon how Glavvostoktruboprovodstroy [Main Administration for Pipeline Construction in the Eastern Economic Region] and Glavtruboprovodstroy [Main Administration for Pipeline Construction] sub-units, to whom the honor of beginning this verifying operation has fallen for the first time on this line, copes with it.

However, in order that the testing work will advance more quickly on the most northerly, the Urengoy wing, of the arterial, and also to the west, the collectives of the trusts Soyuzgazspetsstroy [All-Union Trust for the Construction of Special Gas Industry Facilities], Nadymtruboprovodstroy [Nadym Pipeline Construction Trust] and Priob'truboprovodstroy [Ob Area Pipeline Construction Trust] and the Ukrainian and Rostov builders are to work more intensely. To the North, for example, the laying of several tens of kilometers of arterial pipeline remain to be completed. However, the job is complicated, not only by the extreme topographic conditions and the hydrology of the locality but also by the caprices of the weather.

Under these circumstances, it is clear that not only days and weeks but even hours are of decisive significance. This means that especially well coordinated operation by Workers' Relay participants is required of all, without exception. Much depends upon the railroaders, the truck drivers and the airmen. It is they who should insure the uninterrupted delivery of reinforced-concrete weights to the line.

The enormous assembly line of construction work extends for almost 5,000 km, from Asia to Europe. To turn over the linear portion of the gas arterial and the compressor stations of the first phase ahead of schedule--that is the general action program of the collective of many thousands.

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GENERAL

EXTRACTION AND USE OF MINERAL RESOURCES IN THE NATIONAL ECONOMY

Moscow PLANOVYE KHOZYAYSTVO in Russian No 8, Aug 83 pp 37-48

[Article, published under the heading "Long-Term Problems of the Economy," by G. Mirlin, senior scientist, Commission to Study Productive Forces and Natural Resources of the Presidium of the USSR Academy of Sciences: "Mineral Resources and the Economy"]

[Text] The economic might of the modern state and accelerated technological advance depend to a decisive degree on the scale and efficiency of utilization of mineral resources extracted from the earth. Today there is practically no branch of industry which is not linked directly or indirectly with the consumption of mineral raw materials. Mighty thermal electric power stations, metallurgical production, rail and maritime, motor and air transportation, public utilities and service enterprises consume vast quantities of mineral fuels -- coal, natural gas, and oil. At the same time natural gas and crude oil are the major raw materials of the modern chemical industry. Development of nuclear power engineering is connected with utilization of uranium ore. All branches of machine building, all modes of land, water, and air transportation, the equipment and apparatus of today's electrical equipment and radio engineering industry, electronics, rocket and space hardware, areas of scientific and technological advance accompanied by the employment of ultrahigh and ultralow temperatures, high pressures and ultrahigh velocities require the employment, as structural materials, of large quantities of ferrous, nonferrous, alloying and rare metals, heat-resistant, anticorrosion and other special alloys. Development of modern agriculture, especially enhancement of soil fertility and crop yields, depends to a considerable degree on the level of utilization of mineral fertilizers. Modern urban development and the construction of industrial structures are inconceivable without the employment of various kinds of stone and other building and structural materials of mineral origin.

The problem of providing an adequate supply of fuel-energy, ore and other mineral raw material resources for the further development of human society has in recent years taken on a worldwide, global character and has become one of the most complex scientific-technical and economic problems of the contemporary era.

Mineral Resources in the 20th Century

Mineral resources, which were created by nature within the earth's crust over a period of many millions of years, are being consumed by man over the course of several centuries and even decades, and at a steadily accelerating pace. This particularly applies to the 20th century, during which the mining of mineral raw materials has assumed vast dimensions in connection with a steady growth of world industrial production. The 20th century is unique in the history of mankind in the dynamic nature of growth and development of industry and utilization of mineral resources extracted from the earth. It has been calculated that the quantity of mineral raw materials mined worldwide just in the first half of the present century (1901-1950) greatly exceeded the total volume of minerals extracted from the earth during the entire history of human civilization. Nevertheless this process is continuing to grow at an even more rapid pace in the second half of the 20th century.

In order to trace the process of acceleration with which growth in consumption and mining of mineral resources is taking place in the present century, and in order to assess the scale of their utilization in modern industry and technology, we present below figures on volumes of the major mineral raw materials extracted in the present century (Table 1).

The overwhelming bulk of the vast quantity of mineral raw materials mined since the beginning of the 20th century was extracted in the period 1961-1980. In volume of minerals extracted from the earth, this period is a unique phenomenon in the history of man's utilization of natural resources. It follows from Table 1 that more than 40 percent of the entire amount of coal mined since the beginning of the 20th century was extracted during this period. Counterpart figures include almost 55 percent of iron ore, more than 73 percent of crude oil, more than 77 percent of natural gas, 64 percent of potassium salts, 66 percent of phosphates, and almost 80 percent of bauxites. The volume of crude oil produced during these few decades -- 44.5 billion tons -- exceeded by a factor of almost 2.5 the entire quantity of oil taken from the earth during the entire preceding 100-year history of the world petroleum industry, from 1860 to 1960 (approximately 18 billion tons).

Figures on growth of annual world mineral extraction volumes since World War II also attest to the vast scale of utilization of mineral raw materials in the latter half of the 20th century.

In a period of three decades (1950-1980), just in capitalist and developing countries alone, mining and production of zinc increased by a factor of 2.4, copper -- 2.8, tungsten -- 3.3, nickel -- 4.6, molybdenum -- 6.8, while bauxite production increased 11-fold. World crude oil production during this period increased sixfold, and natural gas production -- eightfold. The current annual mineral raw materials requirements of the capitalist economy are estimated at 450-500 billion dollars, more than 65 percent of which covers fuel raw materials, including 44 percent for oil and more than 20 percent for coal, natural gas, and uranium.

Table 1

(1) Виды минерального сырья	(2) Динамика добычи по периодам				(3) Всего с начала века (1901— 1980 гг.)
	1901— —1920	1921— —1940	1941— —1960	1961— —1980	
(4) Уголь: (5) млрд. т (6) % суммарной добычи с начала века	21,8	25,7	35,5	58,5	141,5
(7) Нефть: (5) млрд. т (6) % суммарной добычи с начала века	15,4	18,2	25,1	41,3	100,0
(8) Природный газ: (9) трлн. м ³ (6) % суммарной добычи с начала века	1,1	3,4	11,7	44,5	60,7
(10) Железная руда: (5) млрд. т (6) % суммарной добычи с начала века	1,8	5,6	19,3	73,3	100,0
(11) Бокситы: (12) млн. т (6) % суммарной добычи с начала века	0,3	1,0	4,8	21,0	27,1
(13) Медь: (12) млн. т (6) % суммарной добычи с начала века	1,1	3,7	17,7	77,5	100,0
(14) Цинк: (12) млн. т (6) % суммарной добычи с начала века	2,9	3,3	5,9	14,5	26,6
(15) Никель: (12) млн. т (6) % суммарной добычи с начала века	10,9	12,4	22,2	54,5	100,0
(16) Молибден: (17) тыс. т (6) % суммарной добычи с начала века	7,6	29,9	207	956	1200,5
(18) Калийные соли: (12) млн. т (6) % суммарной добычи с начала века	0,6	2,5	17,2	79,7	100,0
(19) Фосфатные руды: (12) млн. т (6) % суммарной добычи с начала века	8,9	14,6	25,2	51,3	100,0
	14,1	25,1	38,8	78,0	156
	9,0	16,1	24,9	50,0	100,0
	0,4	1,3	3,1	8,4	13,2
	3,0	9,9	23,5	63,6	100,0
	3,6	98,0	443,4	1267	1812
	0,2	5,4	24,5	69,9	100,0
	10,6	35,7	74,3	219	339,6
	3,1	10,5	21,9	64,5	100,0
	80,0	172,5	337,5	1250	1880
	4,2	9,2	20,1	66,5	100,0

Key:

1. Types of mineral raw materials	11. Bauxite
2. Dynamics of extraction by periods	12. Million tons
3. Total from beginning of century	13. Copper
4. Coal	14. Zinc
5. Billion tons	15. Nickel
6. Percentage of total extraction since beginning of century	16. Molybdenum
7. Crude oil	17. Thousand tons
8. Natural gas	18. Potassium salts
9. Trillion m ³	19. Phosphates
10. Iron ore	

Note: World production figures are given for coal, crude oil, natural gas, and iron ore. Production in capitalist countries is given for the remaining minerals

Growth in world production of mineral raw materials is taking place with a simultaneous and continuous growth in the difficulty of mining mineral deposits. A large percentage of mineral deposits discovered at shallow, more easily accessible depths of the earth's crust have come into commercial exploitation in the 20th century, and particularly in recent decades. In the majority of the world's commercial mining regions, extraction of coal, ore and other solid minerals has dropped from depths of tens of meters and a few hundred meters to 400-600 meters, in many areas to 700-1,000 meters, while some mines have reached depths of more than 1.5-2 and even 3 kilometers. As a consequence of many years of intensive exploitation, a great many large and rich deposits are becoming exhausted, and average metal content in the extracted ore is steadily declining. In the 19th century, for example, average copper content in the ore produced from the world's copper mines usually ran from 10 to 4 percent, declining to 4-2 percent in the first half of the 20th century, while today it has dropped to 1.5-0.5 percent in the majority of ore bodies being mined. According to the figures of the U.S. Bureau of Mines, for example, average copper content in that country's mines declined from 2.5-3 percent at the beginning of the century to 0.7-0.6 percent at the end of the 1970's. In the major regions of rich complex ore deposits in Australia, Canada, the United States, Mexico and a number of other countries, average lead content in the mined ore has declined in the last 30 years (1950-1980) from 3-5 percent to 1.5-2 percent, with zinc declining from 8-10 to 4-6 percent. The trend toward a steady decline in average metal content in mined ores is inevitable to a certain degree, since ore bodies containing not only high-grade but run-of-mine and even low-grade ores are being brought into commercial exploitation as production rises.

The problem of satisfying steadily growing requirements in mineral raw materials is becoming increasingly more acute and difficult to solve for the majority of industrially developed capitalist countries. This is connected not only with industrial production growth and a substantial decrease in domestic sources of raw minerals which are relatively accessible from a technical and economic standpoint, but also with the unstable nature of importation of raw material resources from developing countries of Asia, Africa, and South America. Many crisis situations and military-political complications which have occurred in recent decades and which are continuing today are a direct reflection of the struggle among the United States, Japan, the FRG, the United Kingdom and other industrially developed capitalist countries for control of sources of mineral wealth. "Interimperialist conflicts are becoming more acute and the struggle for markets and sources of raw materials and energy is intensifying," it was stated at the 26th CPSU Congress. "The monopolies need other countries' oil, uranium, and nonferrous metals -- and the Near East, Africa, and the Indian Ocean are declared to be spheres of U.S. 'vital interests'."*

As a consequence of the natural-geologic peculiarities of the structure of this planet's continents as well as parts of continents, the geographic distribution of mineral deposits is highly non-uniform from country to country. The largest

* "Materialy XXVI s"yezda KPSS" [Proceedings of the 26th CPSU Congress], Moscow, Politizdat, 1981, pp 20-21.

reserves of many major types of mineral raw materials are concentrated in developing countries. Their percentage share of the total proven reserves of the capitalist and developing countries, according to figures for the beginning of the 1980's, is as follows: oil -- almost 90%; natural gas -- approximately 70%; bauxite -- 74%; tin -- 87%; cobalt -- 90%; copper -- more than 65%, phosphorites -- 75%; nickel, antimony, and apatites -- 60%. In addition, large reserves of other minerals, such as coal, potassium salts, manganese, chromium, etc have been found in capitalist countries. These reserves are extremely unevenly distributed from country to country, however. For example, more than 83% of coal reserves are concentrated in only five countries -- the United States, FRG, United Kingdom, Australia, and the Republic of South Africa; all the rest of the countries of the capitalist world combined contain less than 17% of total coal resources. Almost 86% of reserves of potassium salts are concentrated in Canada, 87% of manganese ore is to be found in the Republic of South Africa and Australia, and almost 93% of all chromite resources are in the Republic of South Africa.

The overwhelming bulk of minerals mined in developing countries is imported by developed capitalist countries. All the countries of Western Europe are dependent on imports from countries in other parts of the world for such important mineral raw materials as iron and manganese ore, chromites, copper, bauxite, nickel, tin, tungsten, molybdenum, asbestos, mica, industrial diamonds, as well as oil and gas (except for the United Kingdom, Norway, and the Netherlands, which are developing oil and gas fields in the North Sea). Japan's economy is practically entirely dependent on mineral raw materials imported from distant countries.

The United States possesses large and diversified mineral resources. But the United States also almost totally meets its industry's requirements in many important raw materials by importation from other countries: 98% of natural diamonds, sheet mica, niobium, graphite, and manganese ore, 97% of tantalum and cobalt, 93% of bauxite and alumina, 90% of chromium ore and metals of the platinum group, 85% of asbestos, 83% of fluorspar, 81% of tin, 76% of nickel, 63% of zinc, and 50% of tungsten. While possessing considerable domestic oil reserves, in recent years the United States has been meeting about 45-48% of its consumption requirements with imports. The considerable importation of mineral raw materials to the United States is dictated not only by the fact of limited domestic mineral resources and the endeavor to expand domestic minerals economically, but is also a consequence of an aggressive policy pursued by the U.S. Government of grabbing the rich and relatively cheap mineral wealth of underdeveloped countries, a policy directed toward gaining control over the major energy sources and the strategic resources of other countries. This U.S. policy is leading to stripping other countries of their national wealth.

Mineral Resources in Development of the Economy of the USSR

In contrast to the United States, Japan, the United Kingdom, FRG, and other capitalist countries, the economy of the Soviet Union is developing almost entirely on the basis of domestic mineral resources and is not dependent on the political and economic fluctuations which take place in the world minerals market. A vast territory, the specific features of its geologic structure and

planned, orderly development of geological exploration activities have made it possible to establish a vast mineral resource potential in the USSR. The economic independence of the USSR in the area of mineral raw materials is one of the major advantages of the Soviet State over all other countries in the world.

All branches of the mining industry in the USSR have today reached a high level of development, and the rate of growth of production of major types of mineral raw materials in the Soviet Union, especially in recent decades, has been even greater than that in other countries of the world (Table 2).

Table 2

Виды минерального сырья	Динамика добычи в России и в СССР в XX в. по периодам				Всего с начала века (1901— 1980 гг.)
	1901— —1920	1921— —1940	1941— —1960	1961— —1980	
(4) Уголь:					
(5) млрд. т	0,4	1,4	4,7	12,6	19,1
(6) % суммарной добычи с нача- ла века	2,1	7,3	24,6	66,0	100,0
(7) Нефть:					
(5) млрд. т	0,2	0,35	1,1	7,55	9,2
(6) % суммарной добычи с нача- ла века	2,2	3,8	12,0	82,0	100,0
(8) Природный газ:					
(9) трлн. м ³	—	0,02	0,21	4,41	4,64
(6) % суммарной добычи с нача- ла века	—	0,5	4,5	95,0	100,0
(10) Железная руда:					
(5) млрд. т	0,1	0,25	0,98	3,87	6,2
(6) % суммарной добычи с нача- ла века	1,9	4,8	18,8	74,5	100,0

Key:

1. Mineral raw materials
2. Production growth dynamics in Russia and the USSR in the 20th century, by periods
3. Total since the beginning of the century
4. Coal
5. Billion tons
6. Percentage of total production since the beginning of the century
7. Oil
8. Natural gas
9. Trillion cubic meters
10. Iron ore

Note: Coal figures cover bituminous coal and lignite; oil figures include gas condensate; iron ore figures indicate merchantable ore.

As is evident from the figures, the percentage share of the last 20 years in growth and development of the Soviet extractive industry has been as follows: in coal mining -- 66% of the total extracted since the beginning of the century, while the world average is 41.3%; in oil production -- 82 (world average -- 73.3%); natural gas -- 95 (world average -- 77.5%); iron ore -- 74.5% (world average -- 54.5%).

Considerable growth in extraction of mineral raw materials and output of finished products connected with mineral raw materials has been achieved in the postwar period, as is indicated by the following figures (in comparison with the prewar year 1940, Table 3).

Table 3

	1940 г.	1950 г.	1960 г.	1970 г.	1980 г.	Увеличение в 1980 г. к 1940 г. раз
(2) Добыча:						
(3) угля (каменного и бурого), млн. т	166,0	261,0	510,0	624,0	716,0	4,3
(4) нефти (включая газовый конденсат), млн. т	31,1	37,9	148,0	353,0	603,0	19
(5) природного газа, млрд. м ³	3,2	5,8	47,2	198,0	435,0	135
(6) товарной железной руды, млн. т	29,9	39,6	106,0	197,0	245,0	8
(7) Выплавка стали, млн. т	18,3	27,3	65,3	116,0	148,0	8
(8) Производство минеральных удобрений (в условных единицах), млн. т	3,3	5,5	13,9	55,4	104,0	32
(9) Производство цемента, млн. т	5,8	10,2	45,5	95,2	125,0	22

Key:

1. Increase in 1980 over 1940, ...fold	6. Merchantable iron ore, million tons
2. Production	7. Steel production, million tons
3. Coal (bituminous and lignite), million tons	8. Mineral fertilizer production (in standard units), million tons
4. Oil (including gas condensate), million tons	9. Cement production, million tons
5. Natural gas, billion cubic meters	

The extensive mineral resources which have been discovered in the USSR are supporting continuous growth of all mining industry branches. In addition the USSR, carrying out its internationalist duty, is giving the CEA member socialist nations considerable help in supporting the development of their economies with coal, natural gas, oil, iron ore, other ores and fuels. In addition, export of raw minerals and mineral products to certain capitalist countries is repaid by these countries by supplying the USSR with technical equipment and materials.

In the Soviet Union, as in all other countries in the world, the conditions of commercial exploitation of mineral deposits are becoming increasingly more difficult and are requiring steadily growing expenditures. This is connected with the fact that a fair number of previously discovered rich deposits are worked out, as well as the necessity of bringing into commercial exploitation deposits with run-of-mine or even relatively low-grade ores, increasing depths of exploration and extraction, and shifting of the extractive branches of industry into this country's new, frequently inaccessible or sparsely populated northern and eastern regions.

The average content of iron in mined ores, for example, has declined for the country as a whole from 48.7% in 1955 to 40.8% in 1965 and 36.5% in 1975. In 1955 production of a ton of merchantable ore required mining 1.2 tons of crude ore, while in 1975 the figure was 1.94 tons, and in 1980 -- 2 tons. This makes it necessary to increase the volume of ore subjected to beneficiation, while at the same time the quantity of gangue discarded in mine dumps is increasing. A decrease in the average content of metal in mined ores is also noted with copper, lead, zinc, molybdenum and other nonferrous metals.

Mining depths are increasing substantially -- more than 100 coal mines and almost as many ore mines have been sunk to a depth of 600 meters and more, while some coal and ore mines have reached or even exceeded a depth of 1 kilometer. The average depth of oil and gas field exploration wells has increased for the country as a whole from 1,350 meters in 1950 to 2,500 meters in 1970, while the depth was approaching 3,000 meters at the beginning of the 1980's. In several parts of the country oil and gas bearing formations at depths of 4-5 kilometers and more are being explored and are producing today.

In recent decades radical changes have been taking place in the geographic distribution of this country's productive resources, connected first and foremost with the discovery and exploration of large new sources of mineral raw materials. There has been a particularly significant shift of extractive branches into the eastern regions of the USSR, which contain great mineral wealth, but which frequently offer harsh and difficult conditions and require considerable labor and material outlays for commercial exploitation. Nevertheless the end economic effectiveness of exploiting these resources is in most cases proving to be quite substantial. The most vivid example of shifting of the geographic distribution of the extractive branches is the radical changes which have taken place in the geography of the Soviet oil and gas production industry, shifts which have taken place only in the last two decades and which are connected with establishment of this country's biggest fuel and energy base in Western Siberia.

Attainment of the high performance levels in further development of the extractive industries which are targeted in the USSR demands utilization not only of presently known deposits but also discovery and accelerated surveying of large new sources of mineral raw materials. The experience of development of the USSR economy indicates that geological exploration and prospecting activities should maintain a substantial lead on the mining and extraction branches, in order to provide them in advance with adequately surveyed reserves and to enable industry to select raw material bases distinguished by relatively favorable technical and economic indices.

Mineral Resources at the End of the 20th and Beginning of the 21st Century. Reserve Potential for Growth

In connection with crisis phenomena in the capitalist economy, and also as a consequence of the increasing complexity of minerals mining, at the end of the 1970's and beginning of the 1980's (1979-1982) there was noted somewhat of a slowing in the rate of growth in consumption and extraction of mineral raw materials, while in some capitalist countries there was even a decline below

the production levels achieved in the mid-1970's. In these years, for example, production of natural gas, iron ore, lead, zinc, tin, and a number of other minerals in the capitalist and in some developing countries stabilized at approximately the same level, while oil production in these countries even declined significantly: from 2.4 billion tons in 1979 to 2.1 billion in 1981, chiefly due to the sharp decline in oil production in Iran and Iraq. Nevertheless, simultaneously with development of modern technology and continuing growth of industrial production (primarily in the nations of the socialist community, as well as in many developing countries), world minerals production is continuing a steady growth. As is attested by numerous forecasts which have recently been formulated and published in various countries, requirements in raw minerals and mineral products will continue increasing in the near future. In spite of considerable contradictions among these forecasts, the majority agree that world consumption and production of major categories of mineral raw materials will increase by the beginning of the 21st century, in comparison with the level at the end of the 1970's and beginning of the 1980's, by a factor of approximately 1.5-2 (such calculations were performed, for example, by UN experts).

It is also possible that in connection with a decrease in the number of high-grade and shallow-depth ore bodies, increasing complexity of technical-economic conditions and growing cost of mining, as well as in connection with measures being taken in many countries to cut back on energy use and materials input, partial replacement of short-supply metals with synthetic materials, etc, mineral raw materials production at the end of the 20th and beginning of the 21st century may grow at a somewhat slower pace than in the preceding decades. Even if one assumes, however, that the average annual level of raw mineral production achieved worldwide by the beginning of the 1980's were to remained unchanged up to the year 2000, one can easily calculate that even with this assumption, in the last two decades of the 20th century it would be necessary to extract from the earth 74 billion tons of coal, 60 billion tons of crude oil, 30 trillion cubic meters of natural gas, and 18 billion tons of iron ore. Consequently, even in this highly improbable case the quantity of mineral raw materials extracted worldwide up to the end of the century would substantially exceed total production for the preceding 20 years (1961-1980), which is already distinguished by unusually high production figures (Table 4).

Taking into consideration the forecasts prepared in various countries, and assuming that growth in world production of the most important mineral raw materials will probably run not less than 1-1.5% per year, total world production for the last two decades of the 20th century can be roughly estimated, as a hypothesis, in the amounts presented in Table 4 (variant 2). It is possible that the figures are more apt to be understated than overstated since, according to a forecast made by UN experts, average annual production growth, for metals, for example, is stated at approximately 3.6% for the capitalist countries. It is evident from the figures in Table 4 that world production of the major types of mineral raw materials in the final two decades of the present century will exceed production for the period 1961-1980 by not less than a factor of 1.2-2, while production of crude oil, natural gas, bauxite, nickel, molybdenum and, probably, a number of other minerals as well, will exceed total production since the beginning of the century (1901-1980).

Table 4

(1) Виды минерального сырья	(2) Добыто из недр с начала века (1901—1980 гг.)	(3) В том числе за 20 лет 1961—1980 гг.	(4) Современный годовой уровень добычи (по усредненным данным за 1980 и 1981 гг.)	(5) 1981—2000 гг. Возможные объемы добычи	
				(6) Вариант 1 При сохранении до 2000 г. современного уровня добычи	(6) Вариант 2 (7) При небольшом ежегодном росте добычи
(9) Уголь, млрд. т	141,5	58,5	3,7	74,0	76,0—79,0
(10) Нефть, млрд. т	60,7	44,5	3,0	60,0	61,0—62,0
(11) Природный газ, трлн. м ³	27,1	21,0	1,5	30,0	33,0—35,0
(12) Железная руда, млрд. т	26,6	14,5	0,9	18,0	19,0—22,0
(13) Бокситы, млрд. т	1,2	0,96	0,08	1,6	1,8—2,0
(14) Медь, млн. т	195,5	100,3	6,0	120,0	130,0—140,0
(15) Никель, млн. т	13,2	8,4	0,5	10,0	12,0—14,0
(16) Молибден, млн. т	1,8	1,3	0,1	2,0	2,1—2,2

Key:

1. Mineral raw materials
2. Produced since the beginning of the century (1901—1980)
3. Of that, in the 20 years 1961—1980
4. Present annual production level (based on averaged figures for 1980 and 1981)
5. Possible production volumes, 1981—2000
6. Variant
7. Continuing the present production level up to the year 2000
8. With a small annual incremental production growth
9. Coal, billion tons
10. Crude oil, billion tons
11. Natural gas, trillion cubic meters
12. Iron ore, billion tons
13. Bauxite, billion tons
14. Copper, million tons
15. Nickel, million tons
16. Molybdenum, million tons

Note: 1. Potential world production is indicated for coal, crude oil, natural gas, and iron ore; for bauxite, copper, nickel, and molybdenum, figures exclude the socialist countries.

2. Coal figures cover bituminous and lignite production; crude oil figures include gas condensate; iron ore and bauxite figures indicate merchantable ore, while copper, nickel, and molybdenum figures include recovered metal.

A question arises: are the mineral resources in the ground sufficient to provide the above-indicated immense production volumes in the period up to the year 2000, as well as for their production to continue in the 21st century? This question is legitimate because, in contrast to other natural resources, mineral resources are not renewable.

The comparison of mineral production volumes in 20-year periods presented in Table 1 attests to the unusually rapid, almost exponential growth in minerals production and consumption, which has alarmed many researchers (especially in industrially developed Western countries) because of the "finiteness" of

mineral resources. Concern over the possible exhaustion of fuel-energy and other mineral raw material resources has become particularly intensified in connection with energy and raw materials crises in the capitalist countries. There have been numerous concerns expressed about the possibility of worldwide exhaustion of mineral resources in the not too distant future. According to the forecasts of some Western investigators, a substantial portion of mineral reserves will be exhausted by the year 2000 or at the beginning of the next century.

While not denying the existence of what is in fact a very complex problem of ensuring the future development of natural resources, one can scarcely agree with such pessimistic conclusions. From a practical standpoint the total physical exhaustion of any mineral seems little probable, or at least highly remote. Of course it is entirely possible that there will occur in specific ore bodies or even in certain countries exhaustion of reserves surveyed down to a certain depth. We know of examples of total exhaustion of proven reserves in certain oil, gold, silver, copper, mercury, and even iron ore deposits. As a result of intensive exploitation of the world's largest gold deposits in the Republic of South Africa, gold reserves have begun to decline, and gold production, which recently (1970) had reached 1,000 tons, declined in 1980 to 670 tons and is showing a tendency toward further decline. The shallower levels in ore bodies have now been completely worked out in many old mining areas of Europe; underground mining of lead, zinc, and copper in these areas has reached a depth of 1.5 kilometers and more.

Nevertheless in the period up to the year 2000, and probably at the beginning of the 21st century, the main obstacle limiting growth in mineral production will be not physical exhaustion of reserves in individual deposits or areas (although one must consider this factor). The economic factor is becoming decisive, due to the steadily increasing complexity and cost of prospecting and exploration, extraction, beneficiation, and all subsequent stages in the processing of mineral raw materials. Therefore only technological advance in the mining and extractive branches of industry, including the development and employment of fundamentally new, highly efficient methods of geological exploration, production methods and systems, mineral beneficiation and treatment processes can overcome or at least attenuate the effect of the above-mentioned negative factors.

In spite of the large quantity of mineral resources which have been extracted and are currently being extracted, proven and projected (predicted) worldwide reserves of the majority of minerals are sufficient to suggest adequate resources for future production. This particularly applies to those countries the territories of which contain large segments of the earth's crust, which are characterized by a diversity of geologic structure and in which consequently the discovery and many new, including large mineral deposits is possible (USSR, Canada, China, United States, Brazil, Australia, India, etc). The critical nature of the problem lies not so much in quantity of mineral reserves as in the fact that a substantial portion of these reserves is concentrated in deposits lying at considerable depths, in difficult conditions, difficult-access areas, or involve relatively low-grade ore. Therefore they can be profitably mined only with employment of the most efficient techniques and high-output equipment.

In spite of the centuries-long history of the world mining industry, for the most part the shallowest depths of the earth's crust are currently being mined. The greatest depths at which ore and other solid minerals are being mined at the present time do not exceed, as was indicated above, 400-600, and less frequently 700-1,000 meters, with only a few mines as deep as 1.5-2 kilometers or more. As for oil and natural gas, in most of the world's oil producing regions wells are producing from depths of 2-3.5 km, and in some areas from depths of 4-5 kilometers, with wells extending down beyond 6 kilometers only in certain fields. But we know of trough zones in the earth's crust in which thick sedimentary beds which can serve as hydrocarbon reservoirs are at depths of 7-10 kilometers and more.

Increase in exploration and production depth, which is becoming possible due to advanced methods and means of penetrating deep into the earth's crust, made possible by modern technology, although involving additional costs, is a promising direction to take and a major reserve potential for greatly increasing mineral resources in the immediate future. At the same time increasing depth of prospecting is the most practicable means of discovering new, rich ore bodies, since the number of high-grade ore deposits lying close to the surface is gradually diminishing. In view of the occurring process of steady decline in the content of metals or other valuable constituents in mined ores, the problem of discovering and surveying deposits of high-grade ore is becoming increasingly more crucial. In addition, supported by the entire arsenal of modern technological advance, methods of beneficiating and processing mineral raw materials should be continuously improved, in order to be able to utilize relatively low-grade ores or ores of complex composition.

Increasing prospecting and mining depths as a means of increasing rich sources of mineral raw materials does not exclude the necessity of the most extensive further development of surface-mining activities in all those cases where ore bodies lie comparatively close to the surface and where they can be surface-mined. Experience indicates that labor productivity in mining coal, ore or nonmetallic raw materials with large, highly mechanized open pits is 4-6 times that of underground mining, while specific outlays are considerably less than in underground mining. In addition, surface-mining comparatively low-grade ores in many cases is technically and economically more advantageous than mining high-grade ores in deep underground mines.

One very important reserve potential for increasing mineral raw material resources is the comprehensive utilization of mineral deposits and radical reduction of mineral losses in mining and processing. The majority of mineral deposits constitute by their geochemical nature a complex of several minerals and complex compounds of chemical elements. Vanadium, cobalt, copper, sulfur, phosphorus, and other elements, for example, are frequently present in iron ore deposits. When appropriate techniques are employed, other so-called accompanying elements, but very valuable elements, including gold, silver, platinoids, cobalt, rare-earth and scattered elements can also be recovered from deposits of nonferrous metal ores (copper, lead, zinc, nickel, etc). Sulfur and helium are found and can be utilized in oil and gas deposits, while many coal seams are sources of germanium. In many instances the technical and economic value of secondary components exceeds that of the principal mineral. The waste rock

of practically any ore deposit can be used as building material. Efficient combined utilization of mineral deposits comprises at the same time a reliable foundation of environmental protection measures.

Maximum reduction of mineral losses during mining and beneficiation, as well as at the metallurgical processing stages or other processing stages is a particularly crucial task. With the present scale of the extractive industry, annual irrecoverable losses of coal, iron, and potassium salts run in the many millions of tons, while losses of nonferrous metals total tens of thousands of tons. Vast quantities of valuable minerals and metals are to be found in mine dumps, beneficiation tailings, and in metallurgical production waste. Frequently the content of valuable components in this waste is not less than in ores currently being mined.

One of the most important ways to increase recoverable petroleum reserves is to boost the percentage of crude oil recovery. Not more than half of the total proven geological crude oil reserves is actually recovered, while the rest remains in the ground and cannot be recovered by presently utilized methods. Therefore only improvement of methods and means of artificially acting on petroleum reservoirs, with employment of all modern technological advances, can solve the problem of recovering that crude oil which presently cannot be extracted.

The continental shelves and seabed of the World Ocean represent a vast, as yet scarcely touched potential for increasing mineral resources. By the 1970's a substantial percentage of world oil production -- more than 20% -- was coming from offshore fields. Oil is being produced from offshore fields in the Persian Gulf and Gulf of Mexico, in the North Sea and Caspian Sea. According to estimates by U.S., French, and other foreign geologists, more than 100-150 billion tons of recoverable crude lies under the oceans and seas. These estimates are comparable with the figures on world petroleum resources in onshore fields. Of course at the same time practical exploitation of oil pools under the deep beds of the seas and oceans is possible only with employment of sophisticated equipment and requires major expenditures.

Looking forward into the future, one can assume that oil and natural gas will continue to play an important role in the fuel and energy balance of many countries not only up to the end of this century but also at the beginning of the 21st century, and will also continue to be an important chemical industry feedstock. Nevertheless, in solving the problem of power engineering of the future, one must consider the steadily increasing complexity and cost of extracting oil and gas. It is becoming absolutely imperative maximally to conserve hydrocarbon resources, especially crude oil. A. P. Aleksandrov, president of the USSR Academy of Sciences, stressed that the fact of limited oil reserves in large fields currently in production and the trend toward increased production costs are making it necessary, in considering the future of the power industry, to alter the structure in such a manner as substantially to increase the relative share of coal in the fuel-energy balance, to hold the share of natural gas at approximately the present level, substantially to reduce the share of crude oil in the fuel balance, and at the end of the 20th century to shift to utilization of crude oil chiefly as a feedstock for chemical and

microbiological industry plants. The entire fuel and energy balance deficit should be covered with a substantial increase in the share of nuclear power engineering with breeder reactors, and further in the future, thermonuclear power engineering.

Marine coastal deposits are a large source of mineral resources; already today marine placer deposits in countries on the Indian Ocean are a major source of tin. Particularly good prospects for increasing mineral resources are linked with iron-manganese nodules, which cover large areas of the seabed in the Atlantic, Indian Ocean, and particularly the Pacific. In addition to iron and manganese, these nodules contain copper, nickel and cobalt. When appropriate technical means are devised for recovering nodules from the ocean floor and when technologies have been developed for their combined processing, ocean nodules may become in the future a major and stable source of these minerals. And finally, seawater itself contains a great many valuable elements and mineral compounds. Already today approximately one third of world consumption of common table salt, one fifth of magnesium production and a substantial quantity of bromine are obtained from seawater.

Synthesis of mineral raw materials constitutes a substantial reserve potential for the near future. In a number of countries, for example, synthetic diamonds are being produced on a large commercial scale, rubies and quartz crystal are being synthesized, and experiments are being conducted on producing synthetic mica. Various plastics and other synthetic structural materials are being produced in the chemical industry, utilizing organic synthesis methods. In many countries large-scale research is in progress, aimed at producing synthetic liquid fuels from coal, fuel shale, and bituminous rock. Of course one cannot assume that synthetic minerals and materials will be able to replace natural mineral raw materials completely or on any large scale. Synthesis of these minerals and materials should be viewed only as a supplementary and important means of meeting the needs of growing industry in structural and other short-supply natural materials.

Limiting the arms race constitutes a vast reserve potential for achieving savings in all types of materials resources. The arms race, which is continuing through the fault of the countries of the Western bloc, is in sharp conflict with the limited nature of mineral resources. In the interests of all mankind the vast quantities of steel, nonferrous metals, motor fuel and other materials expended on arms could be channeled into nonmilitary sectors of the economy and help raise world living standards.

Thus in spite of the great complexity of the problem of providing mineral resources for future growth and development, a problem which is arising as the 20th century comes to an end and the 21st century begins, there exist sufficiently large reserves and powerful means to counter a decrease in mineral resources. Realization of this reserve potential is grounded first and foremost on further scientific and technological advance, countering those difficulties and negative trends which naturally arise in connection with the constantly increasing consumption of mineral resources. With a priority rate of technological advance, providing the most efficient techniques of mining and processing minerals, with simultaneous adoption by industry of efficient and resource-conserving technologies, the problem of providing adequate mineral raw materials can without question be resolved.

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